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SMITHSONIAN DEPOSIT.

Riter-Conley Manufacturing Company

STEEL CONSTRUCTION

Pittsburgh

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KOPPERS OVENS

The KOPPERS by-product coke plant of the Laclede Gas Light Company at St. Louis, Mo., is giving results that excell any other method of gas, coke and by-product production.

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First National Bank Building

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THE AMERICAN
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VOL. CIII., No. 12. NEW YORK, SEPTEMBER 20, 1915. WHOLE No. 2,122.

COLLECTIVE GAS EXHIBIT WINS HONORS AT EXPOSITION.

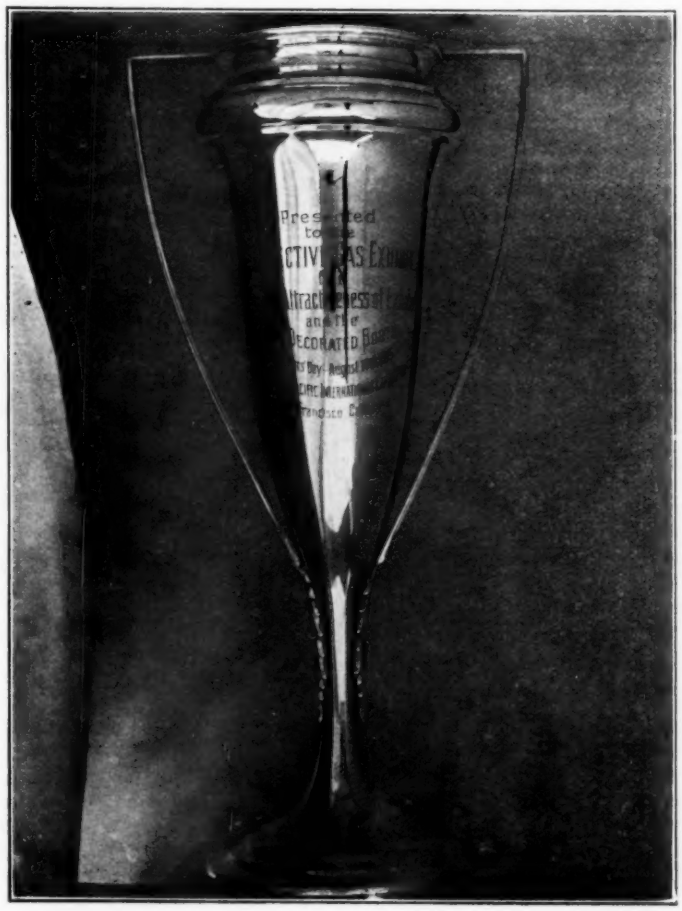
Under the auspices of the Vim Club the twelve hundred exhibitors in the Palaces of Varied Industries and Manufactures, at the Panama-Pacific International Exposition, held a special day for the entertainment of their friends and customers on August 10th, which was officially declared by the Exposition as "Exhibitors Day." The two palaces were gaily decorated, flags, banners and greenery screening the rafters of the great structures, and special attention was given to each booth by the exhibitor in charge.

Valuable articles of merchandise on display by the various exhibitors were donated as prizes, and free tickets for these prizes were distributed at the entrances to the Exposition as the visitors passed through the gates. The buildings were open at 9 A.M., and within a short time visitors were arriving in large numbers. By 11 o'clock both buildings were filled with interested spectators, and special demonstrations at many of the booths attracted hundreds into groups in front of them.

Special exercises were held in the Court of Flowers, between the two buildings, at 1 P.M.; a number of interesting addresses were delivered, and President Charles C. Moore presented an engrossed testimonial of appreciation to the Exhibitors' Association. The Exposition furnished bands for the two buildings for a portion of the afternoon, and during the remainder of the day groups of Spanish and Italian street-singers serenaded each of the exhibitors, or sang in the aisles of the buildings, and a Hawaiian string orchestra added to the carnival air of the day.

For the first time these two buildings were open to the public until 11 o'clock at night, giving an opportunity to the thousands of visitors to inspect the interior illumination of these magnificent palaces, and to thoroughly appreciate the part that gas plays in the lighting scheme. The Collective Gas Exhibit was the brightest spot in the two buildings, and until the closing hour was crowded with visitors, who were loud in their praises of the arrangement of the displays, and of the wonderful lighting effect.

Keen competition had been aroused among the various exhibitors in decorating their booths, as a handsome silver loving cup had been donated by the Baird-North Company, Providence, R. I., for the most attractive and best decorated booth. Judges were appointed who viewed the exhibits, both during the day and at night, and the Collective Gas Exhibit was unanimously declared the winner of the cup, which is herewith reproduced, with the letter addressed to Jno. B. Redd, Superintendent of the Collective Gas Exhibit, by the Chairman of the Executive Committee.



MR. JNO. B. REDD, August 12th, 1915.
Supt. Collective Gas Exhibit,
Palace of Manufactures,
Panama-Pacific International Exposition, San Francisco, Cal.

DEAR SIR: I take great pleasure in informing you that the Jury on Special Booth Decorations has unanimously declared that the Collective Gas Exhibit is deserving of the silver loving cup, donated by the Baird-North Company for the general attractiveness of exhibit and the best decorated booth in the Palace of Manufactures on Exhibitor's Day, August 10th.

The Gas Industry should be proud of the Collective Gas Exhibit, which won this cup in competition with such a large number of other handsomely decorated booths.

Yours very truly,
(Signed) R. A. BRUSH,
Chairman of
Executive Committee,
Exhibitor's Association.

The attendance at the Exposition on this day was 83,500 people, and fully 85% of this number visited the two palaces and viewed the various exhibits.

Following is the Executive Committee of the Exhibitors Association, and the ones to whom so much credit is due for the great success of this event:

E. A. Brush, Chairman, Eaton, Crane & Pike Co.
W. T. Sweatt, Advisory Chairman, P. P. I. E.
Jno. B. Redd, Secretary, Collective Gas Exhibit.
T. Takesawa, Japan Exhibition Society.
Umberto Frilli, Italian Exhibit.
S. Van Der Steen, Commissioner, British Exhibits.
A. S. Bigley, Bigley Lace and Curtain Co.
Hiram A. Long, Baird-North Co.
Geo. S. Pearson, American Stove Co.
T. O. Cowdrey, Armstrong Cork Co.
W. D. McKissick, The United States Leather Co.

(Continued from Page 171.)

Motor Fuels.

"Cracked" Spirits.

From the Fothergill Lecture by PROFESSOR VIVIAN B. LEWES.

I have mentioned the large quantity of residual oil that is cracked in America for the production of motor fuel, and there is no doubt that while the world's production of crude oil remains at its present enormous figure such processes will be able to supply sufficient spirit to keep gasoline up with the demand. The cracking of oil depends on the property of heavy hydrocarbon molecules, dissociating under the influence of heat into simpler groupings of their atoms, so that when a heavy hydrocarbon is heated, instead of breaking up at once to carbon and hydrogen, the decomposition takes place in step with formation of bodies of more and more simple structure, until eventually entire decomposition takes place, and while this is going on the action of heat on the disintegrated groups of hydrocarbons nascent in the solution brings about polymerization amongst them, and leads to the formation of lighter as well as heavier portions of an asphaltic character. If, however, the right conditions of temperature and pressure are employed, it is possible to convert a large percentage of the heavy residual oil into fractions light enough to be used as motor spirit.

The fact was first noticed in America in 1861, and four years later James Young, the father of the Scotch shale-oil industry, found that in the fractional distillation of the shale oil the volume of light spirits obtained could be largely increased by pressure.

We have seen that the saturated hydrocarbons form a complete series, of which methane or marsh gas is the first member, each succeeding member of the group being formed by the addition of the group of CH_2, so that in each member of the series the ratio of carbon to hydrogen may be expressed by the formula C_nH_{2n+2}. The four simplest members of the group are gaseous, with the fifth commence the liquids, extending from C_5H_{12} to $C_{14}H_{30}$; the hydrocarbons then become semi-solid, vaseline being a mixture of $C_{15}H_{32}$ and $C_{16}H_{34}$; and still higher we have true solids, such as paraffin wax, the highest member of the group isolated being $C_{36}H_{72}$. It appears that the primary action in "cracking" is a resolution of the heavier paraffin hydrocarbons into simpler members of the paraffin and olefine series.

Thorpe and Young showed that by "cracking" a definite hydrocarbon of the higher members of the paraffin series, under a pressure of 25 pounds and at a temperature that could only be as much above its boiling point as the increase caused by the pressure employed, it was possible to split it up into the whole series of paraffins and olefines containing a less number of carbon atoms in the molecule than the body taken. Further, they showed that the two series of hydrocarbons were present in the portion of the resulting oil boiling below 100° C. in nearly equal amounts, but that in the higher fractions the portion of saturated to unsaturated hydrocarbon became higher and higher. Important as these conclusions are, a study of the original memoir shows other deductions that may be made of quite as great value.

In the formation of simpler hydrocarbons from more complex, the factor that governs the course of the reaction and the nature of the new compounds, is the degree of temperature employed. This is not given in Thorpe and Young's paper; but the specific gravity of the paraffin wax used, and its melting point were carefully determined, and the pressure under which it was distilled was 25 pounds; and from these we know that the temperature used in the action could not have been much over 300° C., say between 300° and 400° C. At this temperature the reaction would be a dissociation, not a decomposition, the difference between the two being that in the former case, under favorable conditions, recombination would take place between the products to form the original body, whilst in a decomposition the products remain separate. That it is dissociation is shown by the fact that if the paraffin wax was heated in a straight sealed tube for 12 hours no change in melting point or composition ensued, but when transfered to a bent tube and distilled backwards and forwards six times, it becomes completely liquid.

In the straight tube, all at the same temperature, there was no separation by condensation of the dissociated parts of the molecule in the vapors, and they recombined; but in the bent tube each distillation and separation built up lighter compounds, that were not dissociated again at the temperature and pressure capable of divorcing the groups of the heavier molecules. The fact that a temperature that will dissociate a heavy molecule is insufficient to break up lighter ones, is made clear by the authors, who took the fraction of oil burning at about 250° C. from a previous make of cracked hydrocarbons and distilled it backwards and forwards in the bent tube 21 times without altering its boiling point or bromine absorption. They say:

"It appears that only paraffins boiling at an extremely high temperature, and those usually solid under ordinary conditions, are thus susceptible of decomposition. The readiness with which they yield liquid hydrocarbons appears to depend upon the complexity of their constitution."

They were undoubtedly right, for the temperature they employed, but neither they, nor the many who have devised cracking processes since, have grasped fully the fact that every simplification of the hydrocarbon molecule requires a higher temperature for its further dissociation, and that where an oil is cracked the largest portion of which distils at 500° C., one must use a temperature liable to overcrack, i. e., decompose the fractions of oil distilling at 300° C. with the resulting formation of tar, gas, and choking with carbon.

Starting with the assumption that their experiments were carried out at a temperature probably about 300° to 400° C., and under a pressure of 25 pounds, we have the conditions under which a heavy paraffin hydrocarbon of uniform composition could be cracked into liquid hydrocarbons with but little gas and no residue of carbon, and as at the present time the great interest of such processes is in the percentage of motor spirit boiling below 150° C. that can be obtained from the original material, it is important to note that from the figures given there must have been a conversion of 19% of wax into spirit—an excellent result, even as compared with what can be done in one cracking by some of the modern processes.

It seems from the memoir that neither separation of carbon nor formation of tarry residues took place, as preliminary experiments are described in which paraffin wax in a bent tube was distilled in a gas combustion furnace from the end containing the wax to the cooled end; then the tube was reversed and the distillation repeated, and after a dozen distillations the distillate remained perfectly liquid, and consisted of a mixture of saturated hydrocarbons and olefines. This is evidently the primary action that takes place, and in the commercial application of the process complications in the results are introduced at once by the use of a mixture of hydrocarbons instead of a simple compound, so that to get dissociation of the main fractions decomposition of the higher ones has to be faced.

Directly decomposition begins to take the place of dissociation the fact is made manifest by the evolution of gas—one cannot have satisfactory conversion unless some gas is being evolved. That is to say, the temperature must be high enough to bring about incipient decomposition in the heaviest molecules in order to ensure dissociation in the most abundant and lighter compounds; but excessive gas means not only heavy waste of hydrocarbons, but thickening of residue by tar and deposition of carbon.

The amount of gas evolved is as good an indicator of the correctness of the temperature as an analysis of the gas is of the character of the conversion. The quantity and character of gas evolved will vary with the oil used, but as long as it is a mineral oil residue the results are fairly concordant for the same temperatures. The class of oil most often employed for cracking work is the fairly cheap grade after the benzene and lighting oil cuts have been taken off; and an experiment that affords a good deal of information is the simple cracking and decomposing of such oil by dropping it into an iron retort heated to definite and carefully maintained temperatures, in much the same way as if the object was to make oil gas. Under these conditions the volume of gas evolved indicates when decomposition commences and its degree, whilst an analysis of the gas shows the ratio of saturated to unsaturated hydrocarbons.

Thorpe and Young showed that when the action was dissociation only, i. e., the perfect condition we desire to aim at, the proportions of the saturated and unsaturated hydrocarbons boiling below 100° C. were nearly equal; and I find that when decomposition has just started the same thing is noticed in the gas, whilst as decomposition increases with temperature, more rapidly with unsaturated than with saturated hydrocarbons, the ratio of these to the unsaturated rapidly increases as decomposition becomes excessive.

Taking a "solar distillate" oil with a gravity of 0.865 and a flash-point of 149° F., and allowing it to drip slowly into a retort heated to a known temperature, no decomposition will show until about 400° C., when gas will begin to be evolved, and will increase

in quantity rapidly with rise of temperature until about 1000° C. is reached, when it is loaded with soot, and all the hydrocarbons are undergoing rapid decomposition. The volume of gas evolved per gallon of oil treated is shown by the following table:

Temperature of retort.....	500° C.	700° C.	900° C.	1000° C.
Cubic feet of gas per gallon.	12	60	72	84

The analyses of the hydrocarbons in the gas given off at various temperatures are:

	500° C.	700° C.	900° C.	1000° C.
Unsaturated hydrocarbons....	39.13	35.56	36.55	22.04
Saturated hydrocarbons.....	42.41	49.45	49.45	54.83
Acetylene	0.05	0.08	0.38	0.46

For such an oil cracked without pressure 500° C. would be the temperature likely to give the best results, as we see from the table that only 12 cubic feet of gas per gallon are formed, so that the wastage of oil is small, whilst the proportions of saturated and unsaturated hydrocarbons are near together, and reflect the proportions in which they would be formed in the liquid residuals.

Having thus fixed the best temperature under ordinary pressure for the particular oil with which we have to deal, the next point to consider is how far pressure will aid in carrying out the process on a commercial scale. Cracking under pressure acts advantageously in two ways; it increases the boiling point and the temperature of decomposition, so that a temperature of 600° C. might be employed without any more wastage than at 500° C., and with a considerable increase in the conversion; and it causes the absorption and polymerization of some of the nascent fragments of heavy molecules, and so adds to the volume recovered, giving a total conversion on the first cracking of 20 to 30%.

It must not be supposed that because Thorpe and Young found the products of cracking a simple paraffin hydrocarbon at a suitable temperature to be only olefines and simpler members of the paraffin series, that the same easily traced compounds constitute a modern cracked spirit. We have been forced by commercial considerations to deal with a residue oil containing nearly all the members of the parraffin series from nonane upwards, and whilst we regulate conditions of working to suit the largest fraction of the oil, we decompose the higher fractions and undercrack the lower, with the result that the spirit obtained contains not only the primary products of dissociation, but also the products of their further decomposition and interactions. In the residues we find not only all the analytic products of the dissociation boiling above 150° C., but also the synthetic results of many polymerizations and secondary reactions that yield heavy compounds, asphaltic bodies, and, if decomposition has gone too far, tar, pitch and carbon.

The interesting class of hydrocarbons known as naphthenes is largely represented both in the spirit and residues, and as these on decomposition break up into hydrocarbons of the aromatic series, if the temperatures used are excessive, traces of them are also found, and the "cracked spirit" is a mixture of far greater complexity than the ordinary gasoline.

So far I have dealt with the cracking of oil by heat aided by pressure, and before passing to the attempts that have been made to obtain improved results by modifications of the process, it will be well to see what has been done by "cracking" alone.

The earlier attempts to crack the heavier fractions of oil took the form of distilling under pressure, and by the use of a relief valve condensing at ordinary pressures, but in 1889 Sir James Dewar and Sir Boverton Redwood patented an apparatus for conducting both operations under pressure, doing away with the objectionable feature of checking the passage of the vapor to the condenser, which must of necessity cause irregularity in the distillation, whilst condensation under pressure gives the enormous advantage that the lighter vapors, such as pentane, come down with the spirit instead of to a large extent escaping, which must always be the case with condensation at ordinary pressure and temperature. Unfortuately, the process was 20 years before its time, light spirit was a drug in the market, and commercial failure was the result; but what the success would have been had the patent been taken in 1909, is shown by the enormous amount of cracked spirit now made in America by an imitation of Dewar and Redwood's process employed by the Standard Oil Company.

In a process exploited here recently, the plant to carry out which is being erected, the oil is forced under pressure through a coil of heated tube, the pressure kept sufficiently high to prevent the separation of any gas, and the diameter of the tube being so arranged in relation to its length that every part of the oil is subjected for a considerable time to the superheating. The tube is continuous, and after the cracking coil, is formed into a second coil, water-cooled, in which the oil now containing the fractions of lowered boiling-point and dissolved vapors, is brought back to a low temperature, and finally escapes through a loaded valve into the receiver, the light fractions being separated by subsequent distillation and the residual oil returned for further cracking. In this way, the first run through gives a conversion of about 22% of the original oil into fractions boiling below 150° C.; and running through five times with removal of the light fractions after each run is claimed to give over 80% conversion,

In considering the commercial aspect of such processes the point to be watched most carefully is the cost of handling, fuel and power. At the oil fields, where residual oils cost little, it may pay handsomely so to treat the oil as to get the highest possible conversion; but over here, with the oil costing at its cheapest 2½d, or 3d. per gallon, and the spirit having to be produced at 8d. in order to compete with gasoline, unless the process is carried out on a very large scale, establishment costs, labor, fuel, etc., will eat into the profits, and as each run with residues show smaller and smaller conversion, there is an economic limit to the recovery.

A very interesting phase of the motor fuel question is the combination of cracking with the recovery of very light spirits from the gases escaping from the oil wells. For some years past "wet" gases, i. e., natural or well gas containing the vapors of pentane and hexane, have been cooled and compressed in order to condense the highly volatile hydrocarbons, and these in turn dissolve propane and butane, which are gaseous under atmospheric conditions; this gives a liquid of very low specific gravity which is too "wild," *i.e.*, evaporates too quickly, for motor work, but which, mixed with grades of spirit too heavy to work well as motor fuel alone, gives the necessary vapor pressure and elasticity in running, whilst the heavy spirit retains the more volatile portions and prevents over-evaporation. In the States the residue oils are largely cracked to a heavy grade of spirit, which when touched-up with the lighter spirit, makes a motor fuel that can be sold cheaply, and is used extensively for agricultural work in the West.

Very much on these lines is one of the most interesting processes that have been brought forward for the manufacture of motor fuel from heavier oils. At a meeting of the Petroleum Technologists, in February last, Mr. W. A. Hall gave a description of his process. In brief the system is as follows:

"The oil is fed, at a rate exceeding seventy gallons per hour, through inch tubes of not more than 300 ft. in length, under 50 lb. to 75 lb. pressure, and so throttled that the speed of the vapor through the tubes exceed 5,000 ft. per minute. The oil is first vaporised in a coil, preheated in the flue by the waste heat of the products of combustion from the furnace, so that it enters the cracking tubes at a high rate of speed. The speed is so great that very little deposit can be formed in the tubes, and interfere with the cracking action; but, as the passage of the vapors through the tubes occupies only about three seconds, no very extensive cracking occurs, as is proved by samples extracted at these points. The temperature in the centre of the tubular nest, is about 550° C.

"The vapors issuing pass into a vertical pipe of twelve or more inches internal diameter, and about 12 ft. high, entering it through a very confined space acting as a throttle, and preferably impinging against a baffle in the large pipe, so that the speed flow is instantly reduced from about 6,000 ft. per minute to a very nominal rate. This converts the energy of speed into heat, a sort of degrading action, much the same as takes place in a throttling calorimeter, the temperature actually increasing some 30° C., notwithstanding the expansion due to a reduction of pressure from 50 lb. to 75 lb. to about atmospheric. Hence we have in this large pipe, which is well insulated, a temperature well above that existing in the inch tubes of the cracker, and as the speed through this large pipe is comparatively slow, a large amount of cracking takes place with no extraneous application of heat, affording no chance for a superheating of the vapors to a temperature higher than that at which cracking takes place.

"By this method the interior of the mass is hotter than the exterior wall of the container, and all the vapors in their upward passage are working towards a cooler condition, thus preventing local superheating, which has always produced the largest amounts of fixed gas, that would otherwise have been condensable product of the character most desired in motor spirit.

"The pipe is filled with small pieces of thin tubing, which present a large surface and collect any carbonaceous deposit.

"One might think that this very large chamber with all its surfaces, and with the slow passage of vapors through it, would act as a dephlegmator rather than a cracker, but in practice, even with oils of a gravity exceeding 0.960, and some very high-boiling fractions, no liquid condensate has ever been collected from the bottom, and the higher the rate of feed of oil, at the same tempera-

ture in the cracker, the higher is the temperature in this secondary cracker.

"The actual temperature of the vapor in the lower portion of this receptacle may exceed the external temperature of the tube near its exit but inside the furnace, by about 30° C.

"From this receptacle the vapors pass through dephlegmators that separate all fractions boiling below the chosen point of cut, and the vapors and gases passing on are conducted without further condensation, and at a depression, into a mechanical compressor working under 70 lb. to 100 lb. per square inch, and then condensed through a cooler under that pressure. The object of the compressor is two-fold. First, it is a means of drawing these vapors at substantially atmospheric pressure through the secondary cracker and the dephlegmators; and, second, it is a means of chemically attaching to the condensable liquid the gases that would otherwise be permanent.

"That any chemical combination between such gases and liquids could thus take place has provoked much question and scepticism, and has led to very extensive tests. It was generally contended that its function could be only that of creating a solution of a gas in a liquid. That an actual and important chemcal reaction does take place has now been established to the satisfaction of some of our best experts."

So far I have dealt with the cracking of oil alone, but during the past ten years several processes have been devised in which steam or water has been introduced with the oil into the cracking ducts, the idea being that hydrogen from the water would affix itself to the heavy hydrocarbons and hydrogenate them into lighter hydrocarbons. To aid this action catalysts have been frequently used, nickel being the most popular.

The idea of the use of nickel as a catalyst is twenty-seven years old, as in 1888 Ludwig Mond took an English patent (12,608 of that year) in which he mentions the treatment of hydrocarbons together with the steam by passing them through heated vessels containing firebrick or iron oxide, and he states that if metallic *nickel is used in place of the iron oxide, then only a moderate temperature is required.*

About 1900 Sabatier and Senderens studied the action of nickel and other metallic catalysts on the hydrogenation of oils, and in the following years there were many more patents taken covering its use. Still later there were a large number of patents taken in America by Dr. Day, Ellis, Kayser and others.

Mond, Sabatier, and Senderens all recognized that such surface action as the nickel exercised took place only at temperature below 300° C., but the more recent exploiters of the idea have drifted back to the heats one would use for cracking, not for hydrogenation. It may have been my ill-fortune, but in such experiments as I have made I have got just as much and sometimes more conversion when using the oil alone as by using water or steam and nickel surfaces at the temperature prescribed (about 600° C.).

I suspect that at the temperatures employed the steam and water play a purely mechanical part, and simply break up the oil volume and hurry the cracking liquid through the hot zones, incidentally forming magnetic oxide with the iron of the ducts, whilst the hydrogen liberated does not hydrogenate the oil, and is found in the gas at this temperature. The nickel seems only to act in reducing the volume of flowing oil into thin streams, and by its conductivity helping the transmission of heat to the oil.

All cracked spirits differ from gasoline in their sickly alliaceous odor. The smell is due to certain unsaturated hydrocarbons, and to remove it by acid treatment would not be commercially possible owing to the loss in volume that would be incurred; but there is one advantage that may be placed to the credit of the "cracked" fuel, and that is that you nearly always find it 10 to 20 per cent. more powerful than gasoline, as its specific gravity for a given range of fractionation is always higher, and so there is a greater weight to the gallon.

One of the troubles of the maker of cracked spirit is that it often has a yellowish color that is difficult to get rid of, due to a naphthene hydrocarbon — "cyclopentadiene" — which polymerizes on standing for some time in light, forming resinous bodies, and causing sticking of valves in use. Indeed, the presence of very high percentages of unsaturated hydrocarbons (shown by bromination) frequently gives rise to this trouble.

I have already pointed out the great complexity of the mixture of hydrocarbons in such spirits, and it is often found that amongst the residues, especially when water or steam has been used in the cracking, there are oils that have distinct drying properties, and if used fresh make quite decent varnishes and vehicles for colors. Indeed, a patent was applied for in 1912 for converting heavy non-drying hydrocarbon oils into drying oils. As far as I have been able to trace the action that gives rise to this, it is that some of the higher members of the acetylene series, such as isoprene, C_5H_8 (hemiterpene), are formed and then polymerise to terpenes, $C_{10}H_{16}$, which on standing, especially in light, gradually absorb oxygen and become converted into resinous bodies, the drying power being then reduced and the color of the oil darkening. There is very little doubt but that some isoprene is formed, and as this is an excellent starting-point for the synthesis of artificial rubber, we may some day see the cracking of oils providing tires as well as fuel to the motor-car!

The chemistry of the tars and residues from cracked oil offers a field for research as fascinating as coal tar, and as the residues contain not only naphthalenes, but also heavy hydrocarbon molecules, capable of being broken up into naphthalenes by further and higher temperatures, it is worth consideration whether they could not be used profitably for the production of aromatic hydrocarbons, which are formed by the shedding off of hydrogen by the naphthalene molecule. At the present time the demand for toluene is increasing enormously for the manufacture of trinitrotoluene for explosive purposes, while if a State-aided attempt is to be made to capture the dye industry, the demand for aromatic hydrocarbons—benzene, toluene, xylene, naphthalene and anthracene—will for some years be far in excess of the supply.

In 1885, when the demand for benzol was high, Nobel Brothers, Liebermann, Burg, Salzmann and Wichelhaus investigated the possibility of obtaining aromatic hydrocarbons from petroleum residues, and obtained excellent results. The slump in the price during the past 25 years, which at one time brought benzol and toluol down to something like 6d. a gallon, led to these processes being abandoned, although I believe the preparation of aromatic hydrocarbons on a small scale is still practiced from Russian petroleum.

Although the usage of the last 15 years causes us instinctively to think of a motor bus as a vehicle driven by an internal-combustion motor, everything points to steam-driven engines shortly challenging their supremacy, and probably ousting gasoline for commercial haulage.

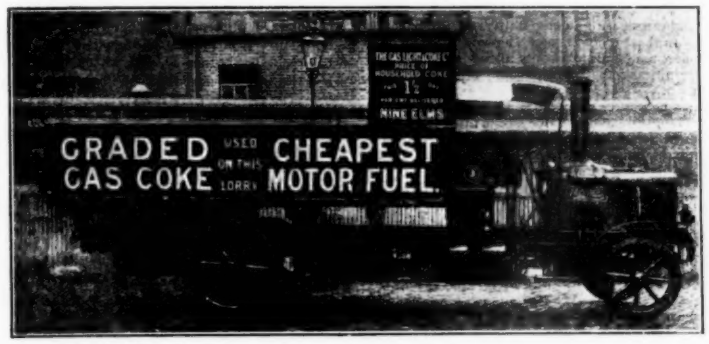
The opening years of the last century saw the inception of the mechanically propelled carriage running on the public roads, and about 1824 steam-driven stage coaches were actually at work. Prejudice and legislative restriction, however, offered but little encouragement, and in 1865 the Locomotive on Highways Act prescribed that the maxim speed should be 4 miles per hour, with a man in front bearing a red flag; and although this was evidenty intended to apply only to heavy traffic, an appeal to the Court of Queen's Bench in 1881, placed every type of self-propelled vehicle under its restrictions, and killed all attempts at development until the repeal of the Act, in 1896, by which time Germany and France, free from grandmotherly care, had got a lead in the development of the motor industry that took this country 15 years to overtake.

It was the invention by Daimler, in 1885, of a motor using petroleum spirit, and the perfection and application of it to vehicles by the French firm of Panhard and Levassor, that led to the remarkable developments that have revolutionized our ideas on travel and traction, and made the motor car a necessity to civilized life. Great as has been the growth of the motor industry in the last ten years, its advance will be even more rapid in the next ten, but the most marked increase will be for commercial vehicles. Many large firms have already replaced horse haulage by the motor lorry and van, but smaller traders, although they realize the importance of following suit, have held back, not so much from a desire to avoid the initial cost, as from a fear of what the working expenses might increase to. The proposed substitutes for gasoline have not yet made any great show on the market, with the exception of benzol, and its price is following perilously close in the wake of gasoline, while the supply in the early future seems far from certain.

Steam Motors.—During the 18 years that the motor car industry has been advancing with such enormous strides, attention has been concentrated almost entirely on perfecting the internal combustion engine, but steam-driven vehicles, especially for traction, have always had supporters who labored to bring them to a degree of perfection to compete with gasoline for heavy work, and in this they were successful; but the first competition with the gasoline-driven passenger vehicle came when, in 1903, the Clarkson steam buses appeared on the road. With the earlier steam-driven lomotives for traction, coke or other solid fuel was employed with hand stoking, and when automatic firing was attempted, jamming in the fuel feed, clinker and other troubles appeared, the result being that in the steam-driven motor bus oil fuel was employed, and we all know how satisfactory the result has been.

During the past year, however, a successful coke-fired boiler and fuel fed, in a motor bus, has been running in regular work with the other vehicles and has given perfect satisfaction.

A similar boiler, fitted to a motor lorry, submitted to the Royal Automobile Club, ran in open competition to Brighton and back on two consecutive days, and was awarded the Dewar Trophy for the most meritorious performance in automobile engineering during the year ended October 15th, 1914. The fuel used was broken coke, passing through a 2″ mesh and held by a 1″ mesh, and on the first day the consumption worked out at 0.62 pounds per ton mile gross, and on the second day 0.56 pound per ton mile, or an average of 0.59 pounds. With coke at 18s. per ton, this works out at about 17-ton miles gross for 1d. as the fuel cost.



The Clarkson Coke-Fuel Truck.—Showing what the gas companies, associated with the London Coke Committee, are doing to extend the use of coke for motor fuel.

Gasoline of the grade used in a motor bus would be contracted for in enormous quantities by the big companies at about 10d per gallon, and 50-ton miles per gallon would be good duty, so that the gasoline-driven motor bus would obtain only 5-ton miles per penny, and the fuel cost would be double that of the steam-driven vehicle; while the small trader, paying 1s. 4d. per gallon for gasoline would obtain only 3.1-ton miles a penny.

The newest type of boiler consists of a forged steel cylinder or drum, closed at the lower end, and fitted with a cover which may be removed for cleansing purposes. The cylinder is placed practically within a firebrick casing, and on the outside of the cylinder a large number of generating tubes project, the tubes being relatively short and of larger diameter. This form of generating tube has superseded the horseshoe pattern, which was formerly employed on the Clarkson steam motors as being easier to clean and repair.

It was first thought that proper circulation of water could not take place in these tubes, as only one end is open, but tests with a glass tube prove that there is a good circulation. The circulation occurs in two phases. Below the boiling point there are two currents in each tube, a lower current from the drum into the tube, and as the water becomes heated it rises into the upper stratum and returns to the drum. The two currents may be clearly demonstrated by adding fine sawdust to the water. After the water has been raised to boiling, the tube being full of water at boiling point, absorption of heat causes a stream of bubbles to flow back to the drum, thereby preventing further admission of water into the tube until the ebullition abates, owing to the water in the tube being used up. The tube never becomes dry, but is about one-third full when at the lowest point, when steaming rapidly at atmospheric pressure. The water in the boiler then rushes in and completely fills the tube, and the cycle of operations is repeated, at atmospheric pressure occupying from 3 to 5 seconds. It is in the nature of pulsating circulation, and, incidentally, this is useful to keep the tubes clean. It has been observed that when a quantity of sawdust is placed in the far end of a tube it is rapidly dispersed; and although it was anticipated that this might give rise to irregular steaming, and possibly cause priming in the boiler, no trace of this has been observed. The boiler steams remarkably well, and, if anything, better than the generator fitted with horseshoe tubes.

The firebrick casing that surrounds the boiler is enclosed in sheet steel, which in turn is surrounded by coke bunkers. There is a large shute on opposite sides of the grate, but although the base of the shute slopes at an angle of 30°, it is insufficient to convey the coke on to the grate, so push-rods or pokers are used, which slowly reciprocate and advance the coke into the combustion area *pro rata* with the combustion on the grate.

Where a chimney is permissible it is by far the best arrangement, and the natural draught is usually sufficient, but for increasing the rate of steaming induced draught is provided by a steam jet in the base of the funnel. The use of a funnel is permissible on practically all classes of merchandise motors, and also for single-deck omnibuses, but when passengers are carried on the roof a funnel cannot be used. In this case the products of combustion are drawn underneath by a steam injector, and discharged at the rear of the vehicle like the exhaust of an internal combustion chassis.

In conclusion, it seems a reasonable inference that the increasing activity in the production of gasoline substitutes, with the use of benzol for motor car work and the advent of new forms of steam-driven motors for commercial traction, will so ease the demand for gasoline as to prevent any further rise in the price while as soon as the depletion in the production of crude oil becomes a serious factor, alcohol will be ready to take its place and be available in any desired quantity to the end of time.

Industrial Safety.

[Paper by CHARLES B. SCOTT, read before the Southwestern Electrical and Gas Association.]

The death toll of the United States in one year from avoidable accidents, equals the total deaths of the Civil War. Statistics, generally accepted as authentic, show that in this county there are 40,000 killed and 2,000,000 injured annually as a result of industrial accidents. For the purpose of a clearer conception of the meaning of such a sacrifice, estimating each fatality at $5,000, and each day of disability at $2, these statistics may be extended and show a direct economic loss of approximately $400,000,000.

Such an estimate does not, however, take into account the incalculable economic loss that must subsequently accrue to the dependents of those killed and injured; nor would it give any accurate idea of the physical and mental suffering, the deprivation and destitution sustained by these dependents, nor the heavy civic burden imposed upon others, for the maintenance of necessary benevolent institutions to care for many of these unfortunate dependents.

During the decade just past, there has been a nation wide awakening to the importance of Safety Work and to the unnecessary and deplorable suffering and loss resulting from preventable accidents. This has resulted in plans and efforts for accident prevention upon the part of almost every industry and State governmental agency, with a great decrease in suffering, destitution and economic loss.

A careful study by specialists has developed the fact that 70 or 75% of the aggregate annual fatalities and injuries resulting from industrial accidents are preventable; and the statistics developed fully justify the general popular favor with which the "Safety First" movement has been received, and the iniative efforts made by many industrial and transportation companies. The conservation of soil, fuel, timber and like natural resources, is not so important as this movement to conserve human life and limb, and our government, properly diligent in the conservation of these first named resources, should devote more time and energy to the conservation of its greatest asset—the lives and limbs of its bread winners.

In the first Safety Work undertaken by the industries, the opinion prevailed that most accidents were the result of the hazards of the industry, due to mechanical conditions; and first attention was given to the safe-guarding of these hazards and the elimination of unsafe physical conditions about the property. While the theory was wrong with respect to the importance of this element of accident prevention, it was, however, not an unwise precedure. The employer's interest in and attention to Safety Work is the first requisite, showing, as it does, his sincerity and earnestness, and proving to the employees his claim on their co-operation. The safe-guarding of mechanical conditions, as a preliminary step, is fully justified, even though it eliminates only about one-fifth of the causes of accidents. The employer, in preparation of a plan designed to conserve the life of his employees, should make the physical conditions of his plant as safe as possible.

It is conservative to say that 75% of industrial accidents are due to thoughtlessness, haste, unsafe habits and unsafe practices of the workmen, and not in any way to lack of mechanical safe-guards or defective physical conditions. Safety work cannot be effective without a realization of the vital importance of the human factor. The education and interest of the man on the job is not difficult to obtain if efforts are properly directed. In plants of any size, an organization providing for systematic and regular consideration of the subject of personal caution is necessary. If Safety Work is considered of secondary importance and spasmodically or indiffer-

ently considered, it will be looked upon by the workmen as a fad, and will receive but little earnest co-operation from them. If, however, the employer makes safety truly "first," and impresses upon his men that it is a common sense part of the business, the employee will readily and earnestly give his support to the movement.

Accident Prevention Work is common sense work, and, like the other activities of the company, is dependent for success upon common sense methods constantly maintained and intelligently directed. An occasional campaign, characterized by entertainments, smokers and moving pictures, will not impress the employee with the seriousness of the Safety business, but is apt to instill in his mind the thought that there is not much in a subject so presented to call for his serious consideration. The intelligent worker finds the business of living a serious matter, and his labor and ability to earn a living a most important fundamental possession. Any movement designed to improve or to conserve these, his chief assets in life, is sure to meet with his commendation and hearty support.

Safety or Accident Prevention is important to the employer for humanitarian and economic reasons, and is similarly important to every citizen. It is particularly important to the worker because he is the directly interested beneficiary, and holds largely within his own power the guarantee of his own safety. To the employer, it is a matter of humanity to the employees, who are for the time his wards, and of returns on an investment of which he is custodian. To the employee it is a matter that concerns his life and his fortune, and oftimes the welfare and happiness of his dependents. The workman is not slow to realize this, and when so impressed and so interested, he becomes a part of the Safety Movement, and is most effective and most valuable in the plant where he is employed and in the community where he resides.

The man who, because of the hurry of modern times or the desire to excel in his work, sometimes takes chances that might eliminate him from the world's activities, has only to be reminded of these things to become interested in this great work of conservation. This is the Accident Prevention spirit, the greatest factor in accident prevention work. It is this spirit of Accident Prevention which, if fostered and encouraged, will do more than anything else to bring about the desired results to the employer who is anxious to rid his plant of preventable accidents. One such man and his influence is a greater factor in the plant than misdirected and unbusinesslike safety methods oftimes employed in an effort to obtain quick-cure results. No successful plan for Safety, no sustained interest on the part of employees can be maintained without the co-operation born of a realization of this individual responsibility of the man on the job.

Whenever an employer desires to promote any of the important operations of his industry, he does so by the development of a carefully studied and well executed plan of organization based upon common sense methods, and by enlisting the co-operation of his organization. The whole force of employees appreciates the saneness of such a plan, and therefore gives it loyal support. Accident Prevention should not be considered differently, but should receive similar business-like attention.

Safety First must not be a meaningless, flippant slogan—Safety First must mean Safety First, and Safety must be a part of the business of the entire force of men and so recognized by every executive, and in the office and in the shop. Not on Safety days alone, but every day—not by a Safety Committeeman alone, but by every man.

Sustained interest in this movement can only be had by maintaining a perpetual organization and sub-organizations, including all the men of the plant, and so systematized that periodic meetings will be held in which all of the members of the respective organizations and sub-organizations will have a chance to participate actively. Participation should include the discussion of accidents and near accidents, and the causes that contributed to them; of opinions of the workmen as to how such accidents or near accidents might have been prevented. Such meetings should be given all the information obtainable, as to all of the accidents in the plant, with accurate analysis of the various causes which contributed to them. The workmen should be encouraged to offer suggestions for the elimination of physical hazards, for the cultivation of thoughtfulness and for the improvement of habits and practices that tend to cause accidents. Suggestions and recommendations originating with the workmen should receive the most careful attention, and they should be advised in all cases as to the reason why any particular recommendation is rejected.

It is remarkable that during the years 1912–1913, 9,772 Safety Suggestions were received from employees of the Chicago and Northwestern Railway, and more remarkable that only 387 of these suggestions were rejected. It is fair to assume that no diligence on the part of that company could have developed so many good ideas on Safety without the assistance of the men who contributed these suggestions. Such co-operation between employer and employee is sure to bring about far more pleasant relations between such companies and the public they serve. Safety work, conducted along such broad and co-operative lines, will be of great economic value to the employer, and will increase the efficiency, welfare and happiness of the worker. It will guard against discontent of the worker and inspire in him increasing interest in the business.

If there were no economic advantages to be gained by accident prevention, the humanitarian reasons alone would justify putting forth every possible effort for saving life and limb, for after all, the economic purposes of life are not the most important ones. The common impulses of good citizenship prompts every man, and every set of men, to perform the duty, as far as it lies in his or their power, to contribute to the welfare and happiness of human kind; and these duties, effectively directed and maintained, will bring a compensation far more satisfying than the accumulation of money or proficiency in the industrial world, in that there will come the satisfaction of having done something really worth while.

It is a good thing for busy men now and then to rest from the strenuous game of business long enough to take an inventory of the greater possessions of life's riches, to think about the other fellow, and to consider the contribution to the cause of happiness and human welfare that every man owes. Our solvency on this point is just as essential as our solvency in business, and perhaps more so. The elimination of such debts to humanity is as important as the payment of debts of dollars and cents. Happy indeed is he who discharges these obligations from day to day—thus becoming rich in these qualities of true living.

"Every life is meant,
To help all lives; each man should live
For all men's betterment."

Dividends to Wage Earners.

Ultra radicals in economics claim to see a menace of paternalism in the recently developed practice of large corporations sharing the profits of the business with their employees, but a commonsense view sees in it the germ of a movement toward the harmonious division between capital and labor of the profits of their joint activities. The Cambridge (Mass.) Gas Light Company has for some years given its employees an annual dividend on the amount of salary received by them in proportion to the profits of the company. This year $10,000 was divided among its 280 employees, 4½% of the aggregate wage of the working staff, for the fiscal year ending June 30.

This is liberal treatment of labor by capital, and emphasizes the difference between a wage contract as a cold-blooded business proposition, and as a co-operative agreement calculated to promote harmony between these two distinct and necessary forces of modern business.

Capital is entitled to a fair return from the business; and the wage earner may well be credited as contributing his wages to the business, and allowed interest thereon like that paid other capital. If more corporations would emulate the action of the Cambridge Gas Light Company in this regard, a great stride forward would be made in solving the labor problem.

Corporation Insurance.

The public utility business is, by its nature, a large employer, and the responsibilities incident to this condition, are appreciated by those in authority.

The latest phase of welfare work is "Employee Insurance," for which part or all of the premium is paid by the company. This is one way of evidencing keen human interest in the employee and his physical wellbeing, and it is being taken up by many corporations. The recent announcement by the Brooklyn (N. Y.) Rapid Transit Company, that it would pay one-half of the insurance policy cost of its 8,000 employees, should act as a spur to the laggards. The policies are for $1,000 each, and the cost to the wage earners will be 8 cents a week. There have been enough policies of this sort written that their effects can be analyzed so that all that a company needs is a small outlay, and the desire to improve the condition of its employees.

Probable Oil Pools in Mississippi.

The people of Mississippi have long thought that the oil pools of the Gulf Coastal Plain are not confined to Louisiana, Texas, or southeastern Arkansas, but that there must be pools farther east in the belt. The United States Geological Survey has held a similar view, and has been examining an area in the Vicksburg region in a search for geologic structure regarded as favorable for the occurrence of oil and gas. The Director in advising drillers as to comparatively promising points at which to do wildcatting, makes plain the fact that while the general geologic conditions from surface evidence, although scarce in this area, are of the kind attending oil and gas pools, there are invisible conditions that may make it barren of oil after all. Hence, while he is disposed to encourage drilling along the folds described in the following paragraphs he wishes it understood that such test drilling will be in the "wildcat" class. That the accumulation of oil and gas in commercial quantities is largely determined by the position of the rock beds (geologic structure) is recognized, and consequently study of the structure of a region and the location of rock folds, particularly arches (anticlines) and domes in the beds, leads to the location of areas in which oil and gas are most likely to occur if present anywhere in the vicinity; yet favorable structure does not guarantee the presence of accumulations of oil and gas.

The region covered by the Survey in a preliminary examination includes the central and northern parts of Warren County and the southwestern part of Yazoo County—an area extending from Warrenton north to Satartia and lying between the Mississippi and Big Black rivers. In general, the southern part of this area covers the Vicksburg quadrangle. In this district the underlying rocks belong to the Vicksburg limestone and Catahoula sandstone, but these formations are so nearly concealed by more recent deposits that they can be seen at a few places only, especially in the upland region, and it is difficult to trace eastward the structure shown along the river bluffs; moreover, the broad bottoms of the Mississippi, in which there are no exposures of the underlying rocks, makes it impossible to trace them westward. However, the structural features found along the Mississippi have been found also along Big Black River, and are, therefore, considered to extend across the intervening area.

Aside from the minor undulations of the rock beds or strata, the structure of the area outlined above was found to consist of two monoclinal folds—that is, the beds, which are in general horizontal over the area, are bent downward and slant off gently in a southerly direction along two approximately parallel east-west lines. The northern monocline crosses the extreme northern part of Warren County from a point near Eldorado post office to the vicinity of Cox ferry, on Big Black River, and the southern one crosses the central part of Warren County in a northeasterly direction from a point south of Vicksburg past Bovina. From Old Calmar post office southward to the southern edge of the city of Vicksburg the beds of the Vicksburg limestone are approximately horizontal; south of Vicksburg, on the other hand, they are bent and dip to the south at the rate of 15 to 20 feet to the mile, and disappear under the overlying Catahoula formation within $3\frac{1}{2}$ miles. The structure found here, while lacking the reverse dip which characterizes anticlinal folding, is very similar to it and appears to present a condition favorable for the collection of oil and gas, especially as the surface structure may be exaggerated in the older beds that lie below the surface.

The location of the southern flexure, where the beds begin to dip southward, is near the south line of T. 16 N., R. 3 E. Washington meridian, about $1\frac{1}{2}$ to 2 miles north of Stout, on the Yazoo & Mississippi Valley Railroad. If this bend in the beds continues eastward, as it doubtless does, it would pass a short distance north of Bovina and cross the Big Black River, near the north line of T. 6 N., R. 4 W. Choctaw meridian. An examination of the exposures along Big Black River shows that the Vicksburg limestones have a dip of 15 to 20 feet to the mile, from the big bend of the river, 2 miles south of Askew Bridge, to Fox Ferry. Within a mile or so north of the ferry, the dip flattens and the beds remain practically horizontal for 6 or 7 miles, until the northern fold or monocline is reached. The northern fold is in every way similar to the southern, only that it extends south of east instead of north of east, and dips to the south at a somewhat greater angle. As mentioned above, the Vicksburg limestones remain practically horizontal from Vicksburg north to to Old Calmar post office; here the ledges of rocks, which may be seen intermittently in the low bluffs along the valley road, are bent upward, and beds that are below the surface further south, gradually make their appearance at the surface. The rocks here dip at the rate of 30 to 35 feet to the mile for a distance of slightly more than 2 miles, and then become horizontal again. Similar conditions are found at a corresponding position on Big Black River. In that locality the dip is from 20 to 25 feet to the mile, and the beds, while flattening to the north, do not appear to become absolutely horizontal. The elevations at corresponding places on each of the two folds are higher on Big Black River then on the Missisippi-Yazoo River side. The axis of this northern fold is in the vicinity of Eldorado post office, probably slightly south of it, in the southern part of sec. 36, T. 9 N., R. 5 W. Choctaw meridian, and extends 20° to 25° south of east, to a point near Cox ferry, in sec. 22, T. 8 N., R. 3 W.

The most promising location for the accumulation of oil and gas, is in the narrow strip, possibly 2 miles wide, lying along the axes of the monoclines, and particularly near the axes. The rocks at the surface here are younger than those in the oil fields in northwestern Louisiana, and consequently a greater thickness must be penetrated to reach the horizon of the productive sands of that region. However, it is possible that productive sands higher than those in Louisiana may be found within easy reach of the drill. There are five geologic formations in this region that contain sands at different horizons, and in which oil and gas might occur—the Jackson, Claiborne, Wilcox, Nacatoch (or Ripley as it is called in Mississippi) and Woodbine (or Tuscaloosa). The first four formations are believed to be within reach of the drill, and the fifth is possibly accessible. As yet the Jackson, Claiborne and Wilcox have not yet yielded oil or gas in commercial quantities, although showings of gas have been found at different places, as for instance, in the Jackson at Sicily Island, in the Claiborne at Boyce and Munroe, and in the Wilcox at Boyce and Natchitoches. The exact depth at which these formations may be reached, as well as their lithologic character, is somewhat conjectural, owing to lack of information on their thickness and constitution at this particular locality. If the thicknesses found in the nearest deep wells of Louisiana and Mississippi are the same here, the following estimates may be made of the depth of these formations below the valley bottom, immediately south of Vicksburg: Jackson, 220 to 1,220 feet; Claiborne, 1,220 to 2,320 feet; Wilcox, 2,320 to 3,170 feet; and Nacatoch, from 3,470 to 3,600 feet. In the northern flexure the depths are about 80 feet less than those given. It will be seen that the thickness of the Jackson and Claiborne are estimated at 1,000 feet each, much more than is usually found. If the thicknesses of the formations are the same near Vicksburg as they are in northeastern Mississippi and western Tennessee, it is possible that the top of the Tuscaloosa formation, or the equivalent of the Woodbine sand, would be reached at between 3,450 to 3,500 feet. If this is the case, all the productive horizons of the Caddo and De Soto fields of Louisiana can be reached by the drill in the Vicksburg region.

However, the oil-bearing sands of those fields are lens-shaped and interbedded with clays, and cannot be expected to continue over wide areas. It is possible that the sands to the west are here represented by deposits formed in deeper water, such as fine-grained clay, or even calcareous material. At Memphis, however, where the conditions are supposedly similar to those near Vicksburg, the Ripley (the equivalent of the Nacatoch) has been prospected for oil and gas and been found to contain numerous sands that made good showings. A detailed discussion of the whole subject will be given in a report, with maps, now in preparation for publication in a bulletin of the Survey.

Meeting Reminder.

Sept. 20–24.—WASHINGTON, D. C.
Illuminating Engineering Society.

Sept. 20–25.—NEW YORK CITY.
Chemical Exposition.

Sept. 23–24.—DETROIT. MICH.
Michigan Gas Association.

Sept. 27.—SAN FRANCISCO, CAL.
International Gas Congress.
American Gas Institute.
Pacific Coast Gas Association.

Oct. 7–8.—NEW YORK CITY.
Empire State Gas & Electric Association.

Oct. .—PATERSON, N. J.
New Jersey State Gas Association.

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CHARLES H. WADELTON, Secretary and Manager.

SANFORD K. CAMPBELL, Editor.

NEW YORK, MONDAY, SEPTEMBER 20, 1915.

[Special Telegraphic Report.]

Canadian Gas Men Meet—Eight Annual Convention at Montreal, Canada.

The Eighth Annual Convention of the Canadian Gas Association opened at the Windsor Hotel, at 9:30 Thursday morning; weather hot, but more comfortable than Wednesday. Alderman McDonnel, representing the Mayor, bade the delegates welcome, which was responded to by Mr. Arthur Hewitt for the Association. Following the roll call, the minutes of the last meeting were adopted as read. The Executive Committee's report told of the part the Association played in the final establishment of the 520 B. T. U. standard, which pleased gas men throughout the Dominion. The reports of the Secretary and Treasurer were followed by the address of President Mann (see page 185) which was well received.

The Nominating Committee, consisting of Messrs. King, Harris, McIntyre, Dean and Gardner, reported for officers as follows:

President, R. A. Wallace, of Quebec; First Vice-President, J. M. H. Young; Second Vice-President, J. S. King; Secretary and Treasurer, John Keillor; Executive Committee, Arthur Hewitt, J. S. Norris; C. C. Folger, A. A. Dean and H. E. Mann.

The President-elect spoke briefly, and after thanking them, he stated that notwithstanding war conditions, the Dominion companies are in excellent shape and no part of the financial burden will fall on the public.

Then came the following papers, "A Motor Driven Gas Pump Installation," by Mr. John S. Haug; "Carbonizing with Verticals at Ottawa," by Mr. A. A. Dion, and "Pipe Laying," by Mr. Chas. H. Osler. The discussions were very animated, as can be imagined from the names of the speakers, Messrs. Wallace, Hewitt, King, Weisgerber and Keillor, and every one was sorry to leave for luncheon.

President Mann came into his own again in the afternoon, as nearly 75 of the members and guests present visited the new La Salle Works—a project which he conceived, designed and built. The plant has ample ground space (some 40 acres), and many features of interest, such as coal handling, etc., in addition to the verticals.

While the men were at the works the ladies were driven through the parks, and to the many points of interest, for which Montreal is noted. Mr. W. B. Johnson, of the local company, has won many friends, his activities as chairman of the Entertainment Committee having met with great success. Smoker to-night, another session to-morrow.—W.

Increase in Natural Gas Output.

The quantity of natural gas produced in 1914 which amounted to approximately 591,866,733,000 cubic feet, valued at $94,115,524, constitutes a new record of production, exceeding by nearly 10 billion cubic feet, or almost 2%, the former record, established in 1913.

A Misleading Report.

The press of the United States contains columns of matter regarding the need of American dyes, and other chemicals. Supplementing this, the United States Government infers, in a report on Thorium, which is analyzed in other columns, that as a protection to the manufacturer of gas mantles, that Monazite Sand be mined in this country, as the price of Thorium is steadily rising. Although, the report bears the date of May, 1915, no mention is made of Monazite produced at Travancore, India, which American manufacturers have been importing and then refining therefrom, Thorium in sufficient quantities for their needs, and at a price lower than that paid previous to the war, for the Thorium imported from Germany.

As long as the India supply is available, the gas industry will be able to obtain Thorium for its needs without making it necessary to mine Monazite in this country, or call upon foreign manufacturers.

Papers at the International Gas Congress, San Francisco, September 27 to October 2.

Tuesday, September 28th—Session 10 A.M.–1 P.M.

President's Address, Dr. Alex. C. Humphreys.
Secretary and Treasurer's Report.
"The Development of Water Gas," O. B. Evans.
"Deep Fuel Combustion as Applied in Water Gas Manufacture," Arthur G. Glasgow.
"The Substitution of Heating Value for Candlepower as a Standard for Gas Quality," R. S. McBride.
2 P.M. to 6 P.M.—Annual meeting of the American Gas Institute.

Wednesday, September 29th, 10 A.M.–1 P.M.

Section A.

Symposium on "Illumination," consisting of six papers, arranged by Mr. C. O. Bond:

"Introduction," C. O. Bond.
"Street Lighting," Geo. S. Barrows.
"Office and Store Lighting," O. H. Fogg and Thos. Scofield.
"Residence Lighting," W. A. Morris.
"Industrial Lighting," R. ff. Pierce.
"Semi-Public Lighting," T. J. Litle.
"Buoy and Car Lighting," George E. Hulse.

Section B.

Symposium "Commercial Aspects of the Gas Business," from the National Commercial Gas Association, under the direction of Mr. C. Willing Hare:

"Commercial Policies," C. Willing Hare.
"Public Relations," E. N. Wrightington.
"Office Management," C. N. Stannard.
"Complaint and Order Desk," W. J. Clark.
"Commercial Accounting," P. S. Young.
"Domestic Fuel Appliances," R. E. Slade.
"Domestic Lighting Appliances," J. D. Shattuck.
"Commercial Lighting Appliances," E. M. Colquhoun.
"Industrial Fuel Business," F. W. Frueauff.

Thursday, September 30th, 10 A. M.–1 P. M.

"Modern Coal Gas Processes," the Society of Gas Engineering of New York.

Symposium "A Review of the Present Practices in the Manufacture and Distribution of Gas by British Undertakings," a contribution from the Institution of Gas Engineers of Great Britain through the late Mr. Edward Allen, engineer of the Liverpool Gas Company, consisting of an introduction and five papers:

"Introduction," Edward Allen.
"Carbonization," John Bond.
"Condensation, Washing and Scrubbing," Dr. W. B. Davidson.
"Purification," J. Ferguson Bell.
"Distribution," Walter Hole.
"Sale of Gas," F. W. Goodenough.

PRESIDENTIAL ADDRESS,

Mr. Howard E. Mann, Canadian Gas Association.

Our industry has suffered from the European War as there has been practically no new developments in the carbonization of coal or treatment of by-products.

It gives me great pleasure to extend to you all a most hearty welcome to the Eighth Annual Convention of the Canadian Gas Association. It is most gratifying to have so large an attendance, and I note with especial pleasure that we have so many visitors from across the line.

Before proceeding further, it is impossible to allow the opportunity to pass without thanking you for the honor conferred upon me in electing me your President.

It is my desire that this meeting at Montreal measure up to the standards maintained by our former Presidents, and its success will depend, not upon the individual efforts of any one member, but upon the co-operation of all our members in the preparation of papers pertaining to our industry, and the open discussion of same.

I wish to lay stress upon the discussion of papers to be presented, for in this way much valuable information is brought out. I therefore request that members and visitors enter freely into all discussions, and thereby co-operate and individually assist in the success of this meeting.

During the past year our industry has suffered from the European war, not in the loss of sales of gas and by-products alone, but there has been practically no new developments in the carbonization of coal or treatment of by-products. Many of the gas works builders of the United Kingdom are now manufacturing war munitions, and we are deprived of this source of development which gave to us in the past stoking and conveying machinery, and of recent date, the continuous vertical retort.

Our industry has contributed war munitions through the supply of drip and holder oil for the manufacture of high explosives.

Our monetary loss from the European war, due to falling off of revenue, is in no way comparable to the destruction of the gas works property in France, Belgium and Russia, or the loss in Great Britian due to the extinguishing of street lighting in many cities, as a protection against Zepplin raids. That our sympathies are with our fellow gas men in these countries is beyond question, the same as our desire for ultimate victory.

At the Ottawa meeting, last year, I called to your attention the gas works we were building at Montreal. It was my intention to submit at this meeting cost figures relative to the operation of the Glover-West vertical retorts. Our installation consists of 14 benches of eights, having a guaranteed production of 4,000,000 cubic feet of gas per day. The guarantee was based on the exclusive use of slack coal for this production of gas.

The plant was started December 10th, 1914, and has operated in part since that date. Owing to the retort being of the slot type, we experienced considerable trouble with charges hanging up. The guaranteed production of gas could not be obtained, and after six months operation it was decided by the contractors to reset the benches, using an oval shaped retort, built up of sectional silica tiles. Seven of the original slot type benches are now in operation; the remaining seven are dismantled for resetting.

It would not be fair to our contractors to submit for publication results obtained to date, and it is with regret that I am unable to fulfil the promise I made you at Ottawa last year.

Mr. Dion, General Manager of the Ottawa Gas & Electric Co., has prepared for this meeting a paper entitled, "Carbonizing Vertical Retorts in Ottawa." The Ottawa installation of Glover-West retorts is identical in design to the retorts first installed at Montreal. These benches have successfully operated for the past six months carbonizing $\frac{3}{4}$" coal. Mr. Dion's paper will contain valuable information regarding the operation of continuous verticals, and the Association is to be congratulated in having these facts presented.

The calorific standard for manufactured gas has been adopted by the Department of Inland Revenue for the Dominion of Canada, superceding the candle power standard which in most countries is now considered obsolete. The regulations pertaining to the standard adopted are as follows:

"The Standard of Calorific Power."

"The standard calorific power of the gas supplied by the undertaker at the prescribed testing place shall be 520 B. T. U. per cubic foot of saturated gas when burned in saturated air, and the volume of gas corrected for a temperature of 60° F. and a pressure balanced by column of 30" of mercury at the same temperature."

"Provided that the undertaker shall not be liable for more than one penalty in respect of a deficiency of calorific power of the gas at any testing place on any one day."

"Penalties for Deficiency of Calorific Power."

"If on any day the calorific power of the gas tested in accordance with the provisions of theso regulations is below the standard calorific power prescribed the undertaker shall be liable to the following penalties":

(a) Companies having over ten thousand (10,000) meters, eighty dollars for the first offence and double this penalty for each subsequent offence.

(b) Companies having five thousand and one to ten thousand (5,001 to 10,000) meters, sixty dollars for the first offence and double this penalty for every subsequent offence.

(c) Companies having two thousand and one to five thousand (2,001 to 5,000) meters, forty dollars for the first offence and double this penalty for every subsequent offence.

(d) Companies having one thousand and one to two thousand (1,001 to 2,000) meters, twenty dollars for the first offence and double this penalty for every subsequent offence.

(e) Companies having one thousand (1,000) meters and under, ten dollars for the first offence and double this penalty for every subsequent offence.

By the adoption of this calorific standard, the Canadian Gas Association has secured for the gas companies of the Dominion an equitable standard for both the consumer and the company, taking into account the small percentage of gas sold for illumination with the flat flame burner. The consumption of gas for fuel purposes is becoming greater every year, and when we consider that the illuminating value of the mantle burner depends upon the calorific value more than upon the candle power, and that the value of gas for industrial purposes is determined by its heating value, it was obvious that the perpetuation of the candle power standard was detrimental to the advancement of our industry.

The Association is indebted to Messrs. Hewitt, Dion and Keillor for their persistent efforts which resulted in the adoption of the calorific standard. Other members of the Canadian Gas Associatian have assisted these gentlemen, and to them we must extend our congratulations.

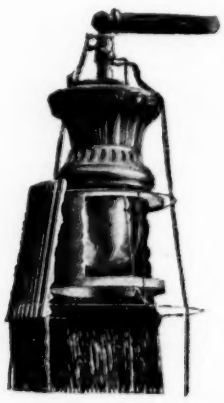
During the past year your President has been asked for advice regarding plant operation and extensions by members of the Association, which suggested the formation of a committe, to whom questions pertaining to manufacture, distribution and extensions could be submitted. This committee to be composed of members qualified by experience to advise regarding information desired. I believe this committe would supply valuable information to members operating small gas works that could not afford the services of an expert. I sincerely trust that this suggested committee meets with your approval, and that action is taken towards the formation of same.

Our Technical Committee has arranged a program to be presented at this meeting which is interestiong in the varied topics treated. It is desired that members and visitors attend the sessions during the reading of papers and enter into the discussions of same. In the preparation of these papers, much valuable time and thought have been given by the anthors, and to them we owe our presence, in recognition of their efforts.

Our Entertainment Committee has prepared for your social enjoyment, a program, which I trust will leave room for no dull moments during your visit to Montreal. Into their hands I commit you after our business session is over.

SILK SHADES FOR GAS LIGHTING.

In view of the growing appreciation for softened and colored light on the part of the consumers, unusual interest is attached to the manufacture of silk shades in various colors that meet the requirements of gas lighting. These shades are not only artistic but are mechanically fit to cope with actual conditions—making for safety, durability and permanent stability. Surely it is not good business to install shades that will ignite, scorch, wear out quickly, or work out of place easily.



Because of the heat radiating from gas lamps, the special combination frames and holders developed by the Storrs Mica Co., open a field of great importance for cultivation. These holders are fitted with heat intercepting, non-conducting mica cylinders designed to give ample ventilation even under the most severe service conditions. The well-known insulating properties of mica keep the temperature of the silk fabric much below that otherwise possible, and the silk is chemically impregnated to render it permanently non-flaming. A thorough diffusion of light and complete screening of the mantle is effected by a process of mica flour frosting over the outer surface of the mico cylinder.

Many special sizes and shapes of Silk Shades are furnished for the standard inverted and upright gas lamps, combining excellent screening effects with small absorption of light in addition to the qualities of safety and dependability.

The protector frames for gas lamps can be had without silk coverings, where it is desired to use a particular fabric to match other material or for any other reason. Such shades should prove permanently serviceable and add to the attractiveness of gas in the home, hotel or wherever artistic and effective lighting is desired.

Coke in Gas Producers.

A paper on the use of coke in gas producers, by Dr. H. Margraf in *Stahl und Eisen*, indicates that there is some difficulty in Germany in getting gas producer coal; the reasons given being that the output of the mines is not as great as in times of peace, because of unskilled men, and that imports from England and Belgium have been very greatly reduced. Much more coal is being coked than formerly, because of the need of the valuable by-products, and the result is a larger supply of coke, and constant effort to replace coal by coke wherever possible.

Many boiler plants have adopted coke firing with good success, and recently experiments have been made in gas-producer practice. At a plant in Lorraine, coke has been used since the beginning of January with complete satisfaction, in a mixture ½ to ¾ coke, and ½ to ¼ coal (nut coal from the Saar, 15 x 35 mm.). The gas is used in the heating furnaces for the rolling mills.

Ordinary revolving grate producers were used, the shaft lined with firebrick and not water-cooled. No changes in the producers were necessary. The largest pieces of coke are broken so that the size is not more than 80 mm. The work of poking is somewhat less than when coal is used alone. The coke settles down uniformly and does not form hollow places, for it does not swell and cake when heated like coal. The ash appears to be somewhat heavier and more solid than that from coal, but its removal offers no difficulties.

The coke used contains practically no volatile matter, so that no heat is absorbed for distillation. The producer therefore showed a tendency to run hot, and it was found that about 10% more steam than usual had to be used with the air. The producers gasify the same quantities of material as formerly.

The gas, of course, differs in composition from ordinary producer gas. Average samples from the plant gave:

	With coke.	With coal.
Carbon dioxide, per cent.	2.0	4.1
Oxygen, per cent	0.0	0.3
Carbon monoxide, per cent	29 to 30	23.6
Hydrogen, per cent	6 to 7	13.4
Methane, per cent	0.5 to 1.0	2.6
Heat value, calories per cu- m	1,130	1,285

While the ordinary producer gas, at the first glance, appears to be the best, it must be remembered that the hydrogen requires double the quantity of air the carbon monoxide needs, and that the nitrogen has to be raised to the temperture of combustion. There are at present no exact results as to the comparison of the two materials for gas producer work, but from a theoretical standpoint the coke would appear to be the best.

It is the general belief that the gas burns with a shorter sharp flame, but this is not the case. In the heating furnaces it shows a very long flame, somewhat more transparent than the ordinary flame, but clearly seen. Also the tests with water tube boilers show that the flame is not short. Sharp short flames are only to be feared with a great excess of air.

New Heat-Insulating Material.

A new fibrous form of silicon oxycarbide of value as a heat insulator has been developed by the General Electric Co., Lynn (Mass.) It is a soft, resilient, fibrous material, which after gentle compression returns to its original shape, and can be cut into plates, sheets and rings that are self-supporting. It is an agglomeration of exceedingly fine fibers, the diameter being about 0.0006 mm., or 1/20 the diameter of a fine cotton fibre. The apparent density of the unworked material varies somewhat, being about 0.15 to 0.18 lb. per cu. ft. The actual density varies from 1.84 to 2.20, according to the variance of the composition from the theoretical $SiCO_2$.

When compressed to 0.8 lb. per cu. ft. it is about twice as good as wool compressed to a density of 12 lb. per cu. ft.; and equal to eiderdown at a density of 5 lb. per cu. ft. The heat-insulating value is approximately halved at a rise from 100° to 500° C. At temperatures above 1000° C. it oxidizes slowly in air, being converted into silica. The heat capacity is very small on account of the very small mass of solid material (0.1 to 0.5% uncompressed). The material is a fair electrical conductor, but if sparking takes place at the contacts it is oxidized to silica, and this introduces an insulating layer.

In the preparation of "Fibrox" a sealed muffle pot of clay-lined graphite has its bottom covered with pieces of silicon and a catalytic agent like calcium fluoride. After a few hours in a furnace at from 1400 to 1500° C. the muffle is found filled with the material.

THORIUM.

An American Industry—No Danger of a Shortage.

THURSTON OWENS.

The three hundred million gas mantles consumed annually throughout the world are dependent upon the supply of thorium. Some eighty million are used yearly in the United States, double the quantity consumed ten years ago. These and other valuable facts are brought out in a recent publication of the Bureau of Mines, prepared by Mr. Karl L Kithil.*

The property of emitting light radiations in the visible part of the spectrum, under the application of heat, has been known and applied for over a century,† but it was Dr. Auer von Welsbach who discovered (1886) that Thorium had the unusual quality of holding together, without other materials being used as a support,‡ hence the mantle mesh.

It was not until 1891 that Dr. Auer perfected his formula of 99% Thorium and 1% Cerium, which produced the highest light efficiency and also the nearest approach to white light in color. For 25 years the mantles used by the gas industry have been produced with this formula as a base; another of the many features of continuity and stability which characterizes the industry.

Thorium is one of the constituents of Monazite sand, the others having great chemical interest, but little commercial value (Whitaker). There are numerous occurrences of Monazite Sand throughout the world, but it has only been mined successfully in North and South America (Kithil). This last statement is open to question as the deposits at Travancore, India, have been the subject of considerable British wrath in the past few months.

"Germany, by underhand as well as straightforward methods, was steadily proceeding towards the fulfilment of her ambition to control the thorium supply of the world when war broke out." The article from which this is quoted goes on to explain how the Auer Company obtained a controlling interest in the leases at Travancore, which was nullified by an edict of the Secretary of State for India reducing the voting power of the "enemy shares," and instructing the company to sell all purchasers upon an equal basis. The British India sand which has reached this country is reported to be far superior to the Brazilian product. The mining of monazite sand in America has been practically abandoned since 1906, and none of the large users see any commercial possibilities in this field.

In order to obtain thorium two definite steps are necessary. The first consists of separating monazite from the other materials mined, which is done in the neighborhood of the mine. The monazite sand is then shipped to the laboratories of the mantle manufacturers where the thorium is manufactured.

"The manufacture of nitrate of thorium from monazite sand is a very difficult and complicated chemical process. It requires from 4 to 6 months to recover the small percentage of thorium and render it sufficiently pure to be used in the manufacture of lighting fluid" (Whitaker).

The treatment of monazite for the extraction of thorium, described by Soddy,§ is as follows: After the sand has been ground the cold mass is dissolved in water and left to settle. The solution is then fractionally precipitated with magnesia, the thorium being concentrated mainly in the first fractions precipitated. The commonest and most useful reagent for precipitating the rare earths from a solution containing common earths, such as alumina, iron, etc., is oxalic acid. Now thorium oxalate is of all the rare-earth oxalates the least soluble in acids, so that by working in fairly strong nitric acid solution, thorium oxalate may often be precipitated and separated, at least partially, from the other rare earths and from calcium. The same is true of the rare-earth phosphates, that of thorium being one of the most insoluble in dilute acids. On the same principle, thorium is often precipitated by weak bases, such as the substituted ammonias, for example, dimethylamine, while zirconium, etc., remain dissolved. The potassium salt of hydrazoic acid, KN_3, precipitates thorium hydroxide only from mixtures of thorium and cerium on boiling. The same separation may be effected by means of sodium thiosulphate on boiling, thorium alone being separated, as hydroxide. This ready hydrolysis of weak thorium is characteristic of the element. The oxalates of thorium and zirconium alone of the rare earths are soluble in ammonium oxalate, and on strongly acidifying the solution, the former alone is reprecipitated. The solution of the oxalate of thorium and its conversion into soluble salts may be effected by means of concentrated ammonium or sodium carbonate and precipitation of the concentrated solution as thorium hydroxide with strong ammonium or sodium hydrate. Thorium is distinguished from the yttrium group of the rare earths by its power of forming a double sulphate with potassium sulphate, insoluble in excess of the latter reagent, and so may be separated from a mixture of the sulphates by saturating the solution with potassium sulphate. Alike in the old, now obsolete, as in the present, technical methods of purifying thorium, the peculiar solubility relations of thorium sulphate in water have been largely applied. The older method consisted in volatilizing the excess of sulphuric acid from the material being treated, and in dissolving the anhydrous sulphates in ice-cold water—a tedious operation—and in heating the solution till the hydrated thorium sulphate was precipitated. The latter was then dehydrated at 300° to 400° and the process repeated. In present practice the sulphuric acid is always kept in great excess in the initial treatment of the mineral, but the sulphate method may be employed at the final stage of manufacture as follows:

The thorium hydroxide is dissolved in hydrochloric acid, so that the solution contains not more than 30% ThO_2, and sulphuric acid is added to the extent of 0.5% more than the equivalent quantity, the temperature being kept low, and in any case below 40° as a maximum. Under these conditions the hydrate $Th(SO_4)_2 8H_2O$ is precipitated, departure from the conditions causing the separation of the tetrahydrate, which is in every way less easily manipulated. The precipitated sulphate is converted into hydroxide, and the process repeated as often as necessary to remove all impurities.

Thorium forms a curious compound with acetyl acetone, $Th(C_5H_7O_2)_4$, which is soluble in chloroform and alcohol, and can be distilled in a vacuum, and so can advantageously be employed for the purification and separation of the element.

It may be mentioned that in the fusion of refractory minerals, as with sodium carbonate, the thorium, if present, is converted into the highly insoluble oxide, ThO_2, and its presence is apt to be overlooked.

MINERALS IN MONAZITE SANDS.

The minerals contained in monazite sands, arranged according to their specific gravity, are shown in the tabulation following:

Mineral.	Specific Gravity.	Letter Showing Relative Quantitative Occurence.
Quartz	2.05	*a*
Feldspar	2.5 to 2.7	*e*
Tourmaline	3.0 to 3.2	
Apatite	3,2 to 3.25	
Epidote	3.2 to 3.5	*g*
Olivine	3.3 to 3.6	
Garnet	3.8 to 4.3	*c*
Rutile	4.2 to 4.25	*h*
Zircon	4,5 to 4.7	*i*
Ilmenite	4.5 to 5	*b*
Monazite	4.8 to 5.3	*f*
Magnetite	5.16 to 5.18	*d*
Gold	15 to 19	*k*

* Monazite, Thorium and Mesothorium, Technical paper 110, Bureau of Mines, Dept. of the Interior Washington.
†The Rare Earths, their Occurrence, Chemistry and Technology. S. I. Levy.
‡ Incandescent Gas Mantles. M. C. Whitaker, Johns Hopkins Lectures on Illuminating Engineering.
§ The Chemistry of the Radio Elements, Frederick Soddy.

Thanks largely to the thorium industry, in which a product unusually pure is essential, there exist therefor a great variety of exceedingly good and sharp methods for the separation and purification of thorium, and it must be understood that ionium, if present, and radio-thorium always remain unseparated from thorium in these processes as far as they have been examined.

In the manufacture of thorium nitrate from monazite a large amount of residues of the cerium group of rare earths is obtained. Monazite containing 60% to 70% of the cerium group or other rare earths besides thorium, and 3,000 tons, which is the annual consumption of monazite, gives about 1,000 tons of cerium and about 1,200 tons of a mixture of the rare earths lanthanum, neodymium and praesodymium oxides. Considerable research work has been done in order to utilize these waste materials, and experiments have been made with almost every one of them. In order to obtain and separate the rare earth elements, thousands of crystallizations and fractionations are necessary, although cerium itself is separated with comparative ease. The untiring work carried on in the research laboratories of the industries as well as by the scientists in both America and in Europe will, no doubt, in time be crowned with successful technical applications of the by-products.

The monazite resources are given by Kithil as follows:

It is difficult to give even a rough estimate of the quantities of monazite obtainable in the various countries. From close calculations, however, it is estimated that the lands in the marinhas along the sea coast of Brazil may yield from 15,000 to 20,000 tons of pure monazite. This does not include coast lands where the deposits have been formed in comparatively short time.

In the interior of Brazil the writer knows of about 18,000,000 of monazite-bearing gravel deposits which should yield monazite containing 4½% of thorium oxide; and it can be estimated that these gravels contain 45,000 to 60,000 tons of monazite. No doubt there will be found many other deposits of greater or less extent in the interior of Brazil, but no single deposit in the interior, so far as known, would warrant the erection of a large plant. In sections where several large deposits are found together, or near each other, a washing and concentrating plant might be profitably established, provided the price for the monazite obtained were higher than at present (May, 1915), and especially if transportation facilities from the interior to the coast become better.

The amount of purified monazite available in the Carolinas may be conservatively estimated at about 15,000 to 20,000 tons (4½% ThO_2).

With better methods of mining and refining, perhaps these deposits could be profitably exploited at the present prices for monazite and thorium nitrate, especially if the mining of monazite were carried on in connection with the manufacture of thorium nitrate and mesothorium.

It is known that attempts have been made to extract the monazite from the native rock, but this operation with even the richest rock known—0.1 to 0.2% of monazite—has proved too expensive.

Duty on Monazite Exported from United States and Brazil.—There is no duty on monazite exported from the United States.

The duties on monazite exported from Brazil vary greatly, and are as follows:

Federal Government.—Duty on monazite from the marinhas—situated along the entire coast and navigable rivers of Brazil—is charged at the rate of 50% ad valorem, and is fixed at £30, or about $150, per ton. Individual States have fixed duties, as follows:

Rio de Janeiro.—Approximately $21 per metric ton.

Espirito Santo.—80% of selling value, established to be £25 per ton. This duty is varying and is subject to reduction when applied for.

Minas Geraes.—12% ad valorem, fixed at £25 per ton and 25% ad valorem, fixed at £25 per ton, plus £2 specific duty.

Import Duties.—The duty on monazite imported into the United States has been 6 cents per pound, but was reduced to 4 cents in 1910, and is now 25% ad valorem.

The import duty on mantle ashes is $10 ad valorem.

The import duty on nitrates has been 25% ad valorem.

The Tariff.

In view of the increased price of thorium, the JOURNAL has obtained expressions from several of the large users of thorium, regarding changes in the tariff that would forestall any increase in the retail price of the gas mantles.

The opinion seems to be general that as long as the American mantle makers can obtain monazite sand from abroad the prospects of using American deposits are doubtful. On the other hand, a reduction in the tariff on sand and an increased duty on the finished mantle, would do much to stablize the industry. As an incentive to American manufacturers, the duty is hardly scientific, as it calls for 25% ad valorem on sand, thorium and on mantles.

If we are to be protected from wholesale dumpings, the rates could better be arranged with free ore, 25% duty on thorium and 40% duty on mantles.

CHARGES, CONNECTIONS AND EXTENSIONS.

Order of California Railroad Commission.

The following regulations have been established by the Railroad Commission of California for the guidance of water, gas, electric and telephone utilities of the State as regards charges, deposits, contracts and guarantees for services, service connection and service extension:

I—Service Charges.

A. Metered Service.

Rule 1. A water, gas, electric or telephone utility may, under uniform, non-discriminatory rules and regulations, require that an applicant for metered or measured service establish his credit before service is delivered, unless prepayment device makes such procedure unnecessary. The applicant's credit will be deemed established if he (1) owns the premises; or (2) makes a cash deposit; or (3) furnishes a guarantor for the payment of his bills, satisfactory to the utility; or (4) has paid all his bills to the utility promptly during the twelve months prior to the effective date of the order herein.

Rule 2. If an applicant for metered or measured service makes a cash deposit to insure payment for service to be delivered, the amount of the deposit shall be such as may be specified in the utility's rules, but in no event in excess of twice the average periodic bill of consumers of his class; provided that the deposit for domestic or residence monthly service of water, gas, electric and telephone utilities shall not exceed $2.50.

Rule 3. If a consumer who has initally established his credit by showing that he is the owner of the premises, or by supplying a guarantor satisfactory to the utility, or by paying all his bills to the utility promptly during the twelve months prior to the effective date of the order herein, later fails to pay his bills, the utility may demand as guaranty for the payment of future bills a cash deposit in the amount provided by Rule 2; provided that service may not be discontinued for failure to make such deposit until the time specified in Rule 5 herein after notice of intention to discontinue service unless such demand is complied with.

Rule 4. If a consumer who has made a cash deposit fails to pay a bill for metered service, the utility may apply the deposit in so far as necessary to liquidate the bill and may require that the deposit be restored to its original amount; provided that service may not be discontinued until the deposit has been fully absorbed, and in no event until the expiration of the respective periods of time after notice of intention so to do, as specified in Rule 5 herein.

Rule 5. A water, gas, electric or telephone utility may not, for failure to make a deposit, discontinue a metered service for which bills are normally made out monthly until the expiration of at least fifteen calendar days after written notice of intention so to do; nor where the bills are normally made out weekly until the expiration of at least four calender days after written notice of intention so to do; nor where the bills are normally made out fortnightly until the expiration of at least seven calendar days after written notice of intention so to do; nor where the bills are normally made out for periods in excess of one month, until the expiration of at least thirty calendar days after written notice of intention so to do.

Rule 6. A water, gas, electric or telephone utility may not discontinue service by reason of non-payment of bills for metered or measured service theretofore delivered.

Rule 7. A telephone utility may, under uniform, non-discriminatory rules and regulations, extend the convenience of sending telegrams and long distance telephone messages on credit to all its patrons or to the extent of such deposits as any of its patrons desire to make.

B. Unmetered Service.

Rule 8. A water, gas, electric or telephone utility delivering unmetered service at flat rates may, under uniform, non-discriminatory rules and regulations, require payment in advance of delivery, for a period not to exceed that for which bills are regularly rendered as specified in the rate schedule, but may not demand guaranties to secure payment for service to be rendered in the future.

Rule 9. A water, gas, electric or telephone utility may not, for failure to pay for service, discontinue an unmetered service for which bills are normally made out monthly until the expiration of at least fifteen calendar days after written notice of intention so to do; nor where the bills are normally made out weekly until the expiration of at least four calendar days after written notice of intention so to do; nor where the bills are normally made out fortnightly until the expiration of at least seven calendar days after written notice of intention so to do; nor where the bills are normally made out for periods in excess of one month, until the expiration of at least thirty calendar days after written notice of intention so to do.

C. Return of Deposits.

Rule 10. After a cash deposit to guarantee payment for metered or measured service has stood unimpaired for twelve months, it shall be returned to the depositor. Upon closing any account the balance of any deposit remaining after the closing bill for service has been settled shall be returned promptly to the depositor.

Rule 11. Interest at the rate of 6% per annum must be paid by each water, gas, electric or telephone utility on all deposits held by it to secure the payment of bills for metered service; provided, that interest need not be paid if the service is discontinued within less than twelve months from the date of first taking service.

D. Contracts.

Rule 12. Except in the case of extension in unincorporated territory, which matter is left open for consideration in subsequent proceedings, and of extensions in incorporated territory in cases in which the commission may hereafter authorize the signing of contracts for service, a water, gas, electric or telephone utility may not require that an applicant sign a contract for service as a condition precedent to service; provided, that such utility may require that reasonable written application for service be made.

II.—Service Connections.

Rule 13. A water, gas, electric or telephone utility which operates upon, under or along any public street, highway, alley, lane or road shall, at its own expense, install a service connection of normal size to the property line or curb line of property abutting upon said public street, highway, alley, lane or road, or to such point on the customer's premises as the utility may agree upon. The term "service connection," as herein used, shall include water and gas pipes, electric and telephone wires, water, gas and electric meters, electric transformers, gas regulators, telephone instruments and appurtenances. Subject to review by the Railroad Commission, a water, gas, electric or telephone utility may refuse to make a service connection if it believes that the service will not be used in the immediate future.

Rule 14. Under reasonable, non-discriminatory rules and regulations, to be prepared in the first instance by the utility, subject to review by the Railroad Commission, a water, gas, electric or telephone utility may provide that the cost of disconnecting and reconnecting service connections may be (1) charged directly to the new or the resuming consumer; or (2) distributed over the periodic payments over a reasonable period of time; or (3) merged in the general operating expense. The so-called "cancellation charges" of water, gas, electric and telephone utilities are hereby abolished.

III.—Extensions.

Rule 15. A water, gas, electric or telephone utility which operates under a general franchise authorizing the occupancy of all the streets of a municipality, shall make, at its own expense, such extensions as may be necessary to serve applicants; provided that in any case in which the construction of an extension at a utility's sole cost, will, in its opinion, work an undue hardship upon the utility or its existing customers, the matter may be submitted to the commission, as provided by section 36 of the Public Utilities Act, unless satisfactorily adjusted by an informal application to the commission.

Rule 16. A water, gas, electric or telephone utility shall make such reasonable extensions in unincorporated territory, at its own expense, as it can agree upon with the applicant for service; provided that in any case in which the construction of an extension at the utility's sole expense will, in its opinion, work an undue hardship upon the utility or its existing consumers, the matter may be submitted to the commission, as provided by section 36 of the Public Utilities Act, unless satisfactorily adjusted by an informal application to the commission.

Rule 17. In any case in which an applicant makes a payment to to secure the construction of an extension by a water, gas, electric or telephone utility, such payments shall be considered as a loan to the utility, to be repaid under reasonable, non-discriminatory rules and regulations. Interest shall be paid on such loans at the rate of 6% per annum.

IV.—Modification of Rules.

Rule 18. A water, gas, electric or telephone utility may establish uniform, non-discriminatory rules more favorable to its consumers than the rules herein established.

2. The rules and regulations herein established shall take precedence over orders heretofore made by the commission in other proceedings, in so far as said orders may be inconsistent with said rules and regulations.

3. The rules and regulations herein established shall take precedence over all rules and regulations filed or to be filed by water, gas, electric and telephone utilities in so far as inconsistent therewith. Rules and regulations now on file and inconsistent with the rules and regulations herein established, should be revised and refiled within 60 days from the effective date of this order.

4. Within 30 days after the effective date of this order, each water, gas, electric and telephone utility shall return to the depositor all deposits heretofore made to guarantee payment for flat rate service and all deposits made to guarantee payment for metered or measured service by patrons who have paid all their bills promptly during the 12 months prior to the effective date of the order herein.

5. If hardship results from the application to special facts of any rule or regulation herein prescribed, application may be made to the Railroad Commission for a modification.

6. This order shall become effective on October 1, 1915.

Substitute Gas for Scarce Petroleum.

Particulars are given in the "Journal fur Gasbeleuchtung" of measures taken in Berlin, Charlottenburg and Stargard, to increase the use of of gas, in view of the increasing scarcity of petroleum.

The announcement of the Berlin Corporation Gas Works states a new type of prepayment meter, which does not include a charge for rent of lighting and cooking apparatus, will be installed; and that no deposit will be required with these new meters. Thus, instead of $23\frac{1}{2}$ cubic feet of gas for a 10-pf piece through the old prepayment meters, the new meters will give $26\frac{1}{4}$ cubic feet. In addition gas-fires will be loaned free.

The notice at Charlottenburg states that incandescent gas lighting is considerably cheaper than oil lighting; that they will make connections to houses at a reduction of one-third from former prices; that payment of such bills will not be enforced until two years after the end of the war; prepayment meters will be installed without a deposit; consumers with prepayment meters giving 22 cubic feet for a 10-pf. piece will be given, rent-free, a three-hole hot plate and three to five incandescent burners; and consumers with meters that pass 24 cubic feet for a 10-pf. piece will be given incandescent burners and lighting fixtures at a reduced rental.

At Stargard, in Pomerania, it is announced that lighting burners up to three in number for living rooms, offices, workshops, etc., may be connected to the cooking and heating supply for a payment of 30 pf. per month per burner. This arrangement is made to facilitate gas lighting, because it would be difficult to obtain meters for all new lighting installations. The difference in price of gas for lighting and heating will be provided for by a monthly charge for each lighting burner.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

KALAMAZOO, Mich., has had an election since Mr. Newbigging made his report, and the result demonstrated that the American public shun the evils they know, for those they know not. They voted against an issue of bonds to purchase the gas plant, and another issue to extend the Municipal electric plant, but in favor of the "Jitney."

REVIVED, b'gosh—and at a time when one end of the country to the other revivals are in order. That gas question—it is an old one, you know—has taken on new life. And judging by the tone of the letter a special committee from the city council have under consideration, the revived question looks like it means business. This from the Waycross, Ga., "Journal-Herald."

THE Richmond, Va., Common Council has voted to reduce the price charged by the municipal plant from 90 to 80 cent per 1,000 cubic feet, effective the first of next February.

THE National Exposition of Chemical Industries opens to-day at Grand Central Palace, New York City. There will be plenty of technical matters covered by papers and discussions, and the exhibits will include those of the following firms, well known to the gas fraternity; Brown Instrument Co., Edward L. Rieha, United Lead Co.

MR. WALTER G. AFRICA, manager of the People's Gas Light Company, Manchester, N. H., was the runner up for the President's Trophy at the championship golf tournament recently held at Maplewood, N. H.

MR. S. W. TODD, formerly manager of the Anaheim (Cal.) office of the Southern Counties Gas Company, has been promoted to the post of district manager for Orange County.

A REDUCTION of 5 cents per 1,000 is announced by Mr. W. F. Clausen, manager of the Winona (Minn.) plant of the Wisconsin-Minnesota Company. The rate schedule which went into effect September 1 is as follows:

First 2,000 feet per month, gross $1.30, net $1.20.
Next 3,000 feet per month, gross $1.20, net $1.10.
Next 5,000 feet per month, gross $1.10, net $1.00.
Next 20,000 feet per month, gross 95 cents, net 85 cents.
All over 30,000 feet per month, gross 85 cents, net 75 cents.
Minimum charge per month, 50 cents.
The present rate is $1.50 per 1,000 gross, $1.25 per 1,000 net.

MR. MARTIN B. DALY, president of the East Ohio Gas Company, announced that the company has obtained a ten-year franchise from the City of Youngstown, O. A new pipe line, estimated to cost $800,000, will be laid from Canton to Youngstown.

THE Alton (Ill.) Gas & Electric Co donated a "beautiful" gas stove for the recent bazarr held for the Hospital in that city. "Alton Times."

THE new 3,000,000 cubic foot holder being erected for the Providence (R. I.) Gas Co. by Messrs. Bartlett Hayward Co. is rapidly nearing completion, and Engineer R. E. Slade states that gas will be turned in by the first of October.

A TRIBUTE to his many estimable qualities, was paid at the funeral of Mr. Israel M. Sternberg on September, 2nd at the church of the Immaculate Conception, Revere Beach (Mass.) by his associates in the Suburban Gas & Electric Co. where he had been employed as superintendent. The floral offerings and the expressions were of real sentiment and affection.

"SIR" JOHN FRANKLIN, a tower in Millville (N. J.) and in the state as well, for that matter, will soon be housed officially in a befitting manner as the company intends to erect the first four story building in the town.

MR. H. M. COLLIN, General Manager of the Glens Falls (N. Y.) Gas and Electric Light Company, announced that after Oct. 1 the local office would be the headquarters for the district, which includes Glens Falls, Hudson Falls, Fort Edward and Whitehall, and for the United Gas and Electric Light Company of Hudson Falls. The general business will be centralized in Glens Falls in order to facilitate the bookkeeping of the corporations. As the result of this move the bookkeeping force in the local office will be increased. Offices will be maintained in Hudson Falls and Whitehall, as heretofore.

MR. CHARLES H. JOHNSON, cashier of the Boston Consolidated Gas Company, and an employee for 63 years, was re-elected director in accordance with the privilege of the profit-sharing employees naming a representative on the board. Mr. Johnson, the oldest employee of the gas company, still remains active in work and interest, despite the fact that he has reached the age of 87, and still retains an unusual keen delight in athletics of all kinds.

THE price of natural gas to Kansas City, Kan., consumers is to be raised from 27 cents per 1,000 feet to 30 cents, next winter, by an order of Judge T. J. Flannelly of the Montgomery County District Court at Independence. The order was made upon application of the receivers of the Kansas Natural Gas Company, which supplies Kansas City, Mo., Kansas City, Kan., Lawrence, Topeka, Leavenworth and several other Kansas towns. The receivers said the increase was necessary to meet the cost of extensions to new gas fields to assure an adequate supply.

CHARTERS have been issued to the Mansfield (Mass.) Gas Co. and to the Foxboro (Mass.) Gas Co.

THE Johnson City (Tenn.) Gas Co. began operations August 30 and consumers are being added daily to its main system. which totals some eighteen miles in length.

AMONG the soldiers, in embryo, at Plattsburg, (N. Y.) is Mr. C. E. Paige manager of the Malden and Melrose (Mass.) Gas Company.

THE Portland (Ore.) Gas & Coke Co. has reduced the price of gas at Oregon City to $1 per M.

SUPT. H. K. MORRISON of the Brockton (Mass.) Gas Light Company is "some" pitcher. He led the team of the Brockton Company against the Lynn Gas & Electrics and won the trophy which he donated!

THE residents of Long Beach, Cal., have been receiving mixed artificial and natural gas from Los Angeles, the rate being $1.00 per M., but they are clamoring for straight natural gas and a lower rate. The Long Beach Company has shut down its local plant, so that the reasons which have enabled the Los Angeles Company to furnish a mixed gas cease to be of importance. Further, straight natural gas can be had from the Fullerton fields.

THE Baltimore (Md.) Company is using the elective system in its educational work, instead of concentrating upon the courses made available by the National gas & electric bodies, has decided to pay one-half of the tuition fee up to $50.00 for any employee who takes courses in a number of Batimore Educational Institutions.

BOTH Los Angeles and Santa Monica (Cal.) have prayed the Railroad Commission for a reduction in Gas Rates. In the "Chemically Pure" city the subject will probably remain a vexing one for all time, but in the latter case an opinion may be looked for in the near future.

THE Board of Gas and Electric Light Commissioners (Mass.) will probably hold hearings in October at Brockton, Mass., relative to gas rates in that city.

FOR purposes of acquisition by the city, the State Railroad Commission recently received a supplementary and amended petition from the city government of Los Angeles, Cal., asking that the distribution system of the Southern California Edison Company, in the San Fernando and Palms districts, be appraised. The State Railroad Commission has already made an appraisal of the distri-

buting system in the city proper, but since the bond issue of 1914, upon which the request for appraisal was based, the two new districts have been added to the city and and must be included in the scheme of municipal ownership of electric power.

THE Gas and Electric Light Commission has decided to hold a hearing on the operation of the so-called "sliding scale act," applying to the price of gas in Boston, Mass., on Sept. 28. This hearing is in accordance with an act passed by the Legislature last year, in place of an act arbitrarily lowering the price of gas to 70 cents per 1,000 cubic feet.

THE Girardville (Pa.) Gas Company is going ahead with its plans to supply gas to Lansford, Summit Hill and Coaldale. The sum of $600,000 is involved in the transaction.

IT is very important that every company tie up directly with the campaign during Lighting Week, which begins next Monday, Sept. 27th, to insure the fullest publicity being given in each community. Companies are urged to illuminate their showrooms and display floors every evening and to have attractive displays of the latest designs in gas fixeures, table lamps and all kinds of lighting units. The National Commercial Gas Association has offered $100 in prizes for the best window displays of gas companies during Lighting Week; the offer is open to every gas man, regardless of whether he is connected with the association or not. The advertising portfolio referred to in our issue of Sept. 6, has brought many calls for electrotypes. The association is also offering to companies a booklet, entitled "Gas Equipment of the Home," giving a number of splendid illustrations covering good gas lighting. There will be many interesting features undertaken by gas companies during this Lighting Week, and some of the larger companies are going to conduct special selling campaigns on lighting units. Some companies will make special reductions in the price of all lighting appliances during that week, others will carry on a special maintenance campaign to insure that every lighting appliance in the territory is properly adjusted and ready to give the best service.

AN example of the possibilities of increasing public favor by lighting week activities is given in a news article of over half a column telling how the Cambridge (Mass.) Company does things under the guidance of Manager Barnes. "One of the most important features of National Gas Lighting Week, which will be celebrated by practically every gas company in the country, during the week of September 27 to October 2, is the invitation of the local gas company to all consumers to make full and free use of its service in insuring the satisfactory operation of gas lights. This free service is not new, nor is it for one week only, but Lighting Week is believed to be a good time to bring it more forcibly to the attention of the public. The gas company is desirous that every gas light in the city shall always be in good condition, because if it is not, it will not be used to the maximum extent nor will the owner feel so kindly toward gas as he should, all of which would mean a loss to the company. Therefore, when the offer is made to clean and adjust lights, free of charge, it is not a case of giving something for nothing, but merely a good business move, which in the end makes money for the gas company, This form of service applies to all lights in residences, and is thus somewhat different from the service given to the stores and factories, where, for a small payment each month, the company sends men at regular intervals to overhaul and adjust the lights, supply new mantles and broken glassware and make other needed repairs. In the case of service to residences, which is known as request maintenance, no charge is made, unless new parts are required, in which case the parts only are charged for at the regular retail prices, and the time of the men who do the work is free. Many persons have hesitated to avail themselves of this gas company service, perhaps from modesty or uncertainty. The gas company wishes it known, however, that there is no string to its offer, but that the calls of representatives to inspect and adjust appliances, are absolutely free, and that if any new parts are needed the representative will give an estimate of the cost and will await the consumer's decision as to whether the work shall be done. With these facts kept clearly in mind, it is hoped that thousands of consumers in the city, during Lighting Week, will notify the company if their gas lights are in need of attention, but with the understanding that at any time of the year this same service is available, etc."

UTILITIES COMMISSION NEWS.

COMMISSION CAN NOT MODIFY FRANCHISE.—The up-State New York Public Service Commission has decided that it has no power to modify the terms of a franchise granted by a municipality. The New York and North Shore Traction Company applied to the Commission asking that it determine, that the just and reasonable fare between Mineola and Port Washington was fifteen cents instead of the ten cents to which the road is limited by the terms of its franchise granted by the Supervisors of Nassau County and the Highway Commissioners of the town of North Hempstead. The attorneys for the road contended that the power to grant franchises in a municipality was but a power delegated to the municipality by the Legislature, and that the legislature itself, or the Commission, to whom the legislature has delegated general power over rates, could amend the franchise.

Commissioner Irvine, in his opinion, cites a clause in the Constitution, providing that no law granting a street railroad franchise can be passed without the consent of the local authorities and the abutting property owners. He says that if the language of the Public Service Commissions law, giving the Commissions power over rates, were to be construed as giving the Commission power to change the terms of a local permission, it would undoubtedly be unconstitutional.

The case has been watched with interest, as, had it been decided that the Commission had the power invoked, nearly all cases in which an admittedly inadequate return is now imposed by the limitation of local franchises might be brought before the Commission, without respect to the local authorities.

LOWER RATE WANTED FROM BROOKLYN SUBSIDIARIES.—George J. Rhodius and Adam Christmann, attorneys for Ridgewood residents who have been demanding eighty-cent gas for Newtown, N. Y. City, submitted a brief Wednesday to the Public Service Commission. The attorneys say that the Newtown Gas Company, in making up its schedule of properties, put the value of its office property at $35,361.20, which was the original price of the property before a $15,000 plot was sold to the City of New York. They assert that much less than the $26,000 put down for expense of laying mains was expended by the company.

They deny that the price of oil used in making the gas had gone up five cents per gallon, and quote from Mr. Jourdan at the annual meeting of the company that from $850,000 to $1,000,000 was saved by a very favorable contract for this year.

The attorneys also attack the setting apart of 10% of earnings for depreciation and for accidents as not based on necessity. They say that the company gets all its gas from the parent company (Brooklyn Union) and, having no manufacturing plant, has small depreciation and little risk of accident. They attack the $196,868 for "preliminary development" in the appraisal and $151,000 for working capital.

LACLEDE GAS BEING HARASSED BY SCALZO.—Extortionate and discriminatory rates are alleged in a complaint against the Laclede Gas Company of St. Louis, Mo,, filed before the Public Service Commission by Felix Scalzo and 500 other residents of St. Louis.

The Public Service Commission ordered a physical valuation made of the company's plant and an accounting of its books to determine whether the rates are excessively high and extortionate as charged. This will require several months. The commission is now engaged in a valuation of the plant of the Union Electric Light and Power Company in a complaint filed by the Engineers' Incitation Club and others. (We venture to suggest that Mr. Scalzo must belong to the Incineration Club.)

The gas rates are higher, the complaint declares, than in Detroit, Milwaukee, Indianapolis or Los Angeles, where conditions are about similar. (Similar!!! No conditions more divergent could be found in all these United States.)

Following are the Laclede Gas Company's rates about which complaint is made:

Illumination and Fuel—Ninety cents a thousand cubic feet gross and 80 cents a thousand cubic feet net for the first 10,000 cubic feet used during one month by one meter. Seventy cents a thousand cubic feet gross and 60 cents a thousand cubic feet net for all gas used in excess of 10,000 cubic feet.

House Heating Exclusively—Ninety cents a thousand cubic feet gross and 80 cents a thousand cubic feet net for the first 10,000 cubic feet used during one month on one meter. Sixty cents a tnousand cubic feet gross and 50 cents a thousand cubic feet net in excess of the 10,000 cubic feet. The company discounts all monthly bills 10% when paid before the discount days have terminated.

Financial Notes.

THE Board of Directors of STANDARD GAS AND ELECTRIC COMPANY has mailed to the stockholders a circular describing a plan of financing, for the further development of the company. This plan contemplates the issue of $3,750,000 twenty-year 6% gold notes, which are offered for immediate subscription. The proceeds of $3,000,000 par value will retire all of the company's short-maturity obligations, its floating debt, and furnish some additional funds, which, with the proceeds of the remaining $750,000 par value now offered, will enable the company to effectively increase its earnings. The plan will not be effective unless the stockholders subscribe for at least $2,000,000 of the notes. The notes are offered to the shareholders at 90, payable in cash or by installments, 20% in cash followed by monthly payments of 10% of the principal. The notes are to be issued under a trust agreement authorizing a total issue of $15,000,000 and providing certain restrictions. Denominations: $1,000, $500, $100 and $50. Subscriptions will close October 15th, unless the time is extended by the directors. If the proposed financing now submitted to the shareholders is successful—and consultation with a number of the large preferred stockholders indicates that it will be—Standard Gas and Electric Company's preferred stock will be immediately placed on a cash dividend basis, starting with 1% for the first quarter. The directors also express the belief that the steady upward progress of the company will continue, and that dividend distribution will increase until it again reaches the 8% per annum provided for the preferred stock. The circular gives recent earnings figures, showing that favorable progress of the company has been accelerated during the 12 months ended June 30, 1915, as follows:

Gross earnings of subsidiaries:	
12 months ended June 30th, 1915	$15,002,758.70
12 months ended Dec. 31st, 1914	14,354,689.07
Increase of 4.51% in 6 months	$648.069.63
Net earnings of subsidiaries:	
12 months ended June 30th, 1915	$7,216,908.72
12 months ended Dec. 31st, 1914	6,741,233.77
Increase of 7.05% in 6 months	$475,674.95

As a result of the decision of the Board of Directors of the CENTRAL HUDSON GAS AND ELECRIC COMPANY, which supplies Newburgh and Poughkeepsie, N. Y., and adjacent territory, the residents of this section will be offered subscriptions of the issue of 10-year convertable depenture bonds of the company, whose issue was recently authorized by the Public Service Commission of the Second District. Mr. A. R. Beal, of the company, stated that the opportunity to subscribe to the bonds was being eagerly accepted by the residents of Orange, Ulster and Dutchess counties, the region covered by the service of the company. Only $300,000 of the authorized issue of $500,000 will be offered by the company at present. Mr. Beal said it would have been easy to have these taken up in large lots by investors in Boston, New York and other cities, but that the company had deliberately adopted the plan to sell among the residents of this vicinity. The Public Service Commission of the State of New York, Second District, has, by order dated August 12, 1915, granted leave to this company to issue $500,000 par value of its 6% 10-year convertible debenture coupon bonds in denominations of $1,000, $500 and $100. Bonds will be convertible at the option of the holder into stock of the company on Oct. 1, 1918, and thereafter, and may be redeemed by the company, if not previously converted by the holders into stock, at 105% of the par value of said bond or bonds, on or after the year 1921. The bonds will bear interest from and after October 1, 1915. The proceeds of said bonds are to be used in extending the properties and equipment of the company, and in reimbursing the company for expenditures already made in such extensions.

SHAREHOLDERS in the UNITED GAS IMPROVEMENT COMPANY as of September 30, 1915, will receive a quarterly dividend of 2%.

THE $1,000,000 4½% WORCESTER (Mass.) GAS LIGHT COMPANY notes, purchased by Kissel, Kinnicutt & Company and Blake Bros. & Company, were all sold September 9. Notes were of different maturities, one, two, three, four and five years, and were sold to yield from 4¼ to 5%.

AMERICAN GAS & ELECTRIC LIGHT CO., regular quarterly of 2% on common, payable October 1 to stock of record September 20, and regular quarterly of 1½% on preferred, payable November 1 to stock of record October 20, is announced.

THE OHIO CITIES GAS COMPANY has declared a regular quarterly dividend of 1¼% on preferred stock, payable October 1 to stock of record September 15.

APPLICATION was made to the Wisconsin Railroad Commission by the MUSKEGON TRACTION AND LIGHTING COMPANY for permission to increase its capital stock to $1,000,000, the present capitalization being $700,000. The object of the increase, it was explained, is to permit the company to pay for the new gas holder now being constructed, retire the company's floating indebtedness, and a $63,000 6% preferred stock issue, which matured some time ago, and provide capital for future expansion.

NEEDHAM, Mass., wants gas, but a local resident by the name of Smith does not want another man named Smith to have the franchise. The town people believe that the franchise is so valuable that a $100,000 corporation should be formed which could then come forward and present its case before the local tribunal in a befitting manner.

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